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New Skills Training Plan for Map Functions and Passage of Lines on a Soldier System

Paul N. Blankenbeckler, Stephen C. Livingston, Michael D. Dlubac, Nancy C. Riffe-Seckinger, and Diadra N. Swinson
Northrop Grumman Corporation

Jean L. Dyer
U.S. Army Research Institute

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Infantry Forces Research Unit

United States Army Research Institute for the Behavioral and Social Sciences

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14. ABSTRACT *(Maximum 200 words)*:

The training products in this report bridge the gaps between training digital and non-digital forces. The new skills plans present ways to teach digital skills associated with new computer-based technologies, but also relate these skills to current procedures and techniques used without these technologies. Consequently, these products help Soldiers learn and retain the new digital skills, and also to retain the associated non-digital skills required to perform the same tasks. The two tasks selected to serve as the prototypes for these training plans are map functions and the conduct of a passage of lines as the stationary unit. Map functions involve a series of individual skills and tasks. The passage of lines as a stationary unit is an amalgam of individual skills and tasks, and collective tasks, and as such is a collective task. This particular collective task focuses at platoon level and below. Included in the plans are a series of increasingly difficult exercises as well as assessment procedures.

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Paul N. Blankenbeckler, Stephen C. Livingston, Michael D. Dlubac, Nancy C. Riffe-Seckinger, and Diadra N. Swinson
Northrop Grumman Corporation

Jean L. Dyer
U.S. Army Research Institute

Infantry Forces Research Unit
Scott E. Graham, Chief

U.S. Army Research Institute for the Behavioral and Social Sciences
2511 Jefferson Davis Highway, Arlington, Virginia 22202-3926

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Personnel Performance and Training Technology

NEW SKILLS TRAINING PLAN FOR MAP FUNCTIONS AND PASSAGE OF LINES ON A SOLDIER SYSTEM

EXECUTIVE SUMMARY

Research Requirement:

How to train Soldiers on new equipment is always a challenge, particularly when the user audience is diverse and the equipment provides new capabilities and features. This document presents training plans that support selected skills dismounted Soldiers and leaders must master in the process of using and employing computerized systems they take with them to combat. Plans are presented for individual skills related to map functions and for the collective task of passage of lines.

Procedure:

The content to be trained was based on software in prototype Soldier systems that incorporate a wearable computer and/or a handheld computer as well as fielded digital systems. Details regarding these software interfaces were based on prior observations of current and prototype systems. The proposed training plans are consistent with Army training principles, but do not contain all the detail of a training support package. The training content is complete. The training strategies in the plans reflect the crawl, walk, run philosophy embedded in Army training doctrine.

Findings:

The training plans for each function/task describe the operational requirements in detail and how computer features provide an enhanced battlefield capability. The plans also specify the prerequisite skills required by Soldiers before being trained. The specific skills that must be trained on the Soldier's computer system are described, along with critical teaching points. This background information is followed by a suggested training plan on how to conduct the training itself. The plan includes the target audience to be trained, assessment of Soldier status on prerequisite skills, followed by comparative training exercises designed to have Soldiers apply the skills or execute a task using current techniques and to have Soldiers do the same skill or task using the digital capabilities inherent in their computer system. Proposed training media are specified. The training progresses through a series of increasingly difficult tasks and exercises, with a field training exercise culminating the training. Performance assessment procedures are described.

Utilization and Dissemination of Findings:

The plans clearly illustrate that the training of computer-based features on future Soldier systems must merge and link tasks, and gradually build on the acquired skills to obtain the final degree of expertise that is desired. With collective tasks, the need to train how to integrate input from multiple individuals was shown to be important. The plans provide guidelines for training the specific skills identified, but they also provide guidelines and insights regarding training that can be generalized to other computer-based functions and tasks.

NEW SKILLS TRAINING PLAN FOR MAP FUNCTIONS AND PASSAGE OF LINES ON A SOLDIER SYSTEM

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INTRODUCTION

How to train Soldiers on new equipment is always a challenge, particularly when the user audience is diverse and the equipment provides new capabilities. For example, determining how to train Soldiers on a new rifle that replaces the current rifle in the Army inventory is less challenging than determining how to train Soldiers on operating a robot and interpreting the visual or auditory feedback from the robot, when they have never used a robot before. This report presents training plans that support skills that dismounted Soldiers and leaders must master in the process of using computerized systems they take to combat.

The computerized systems of interest can be either a wearable or a handheld system. Wearable systems are integrated in both Soldier and leader ensembles, and must meet weight and power requirements which typically restrict the computer's processing capability. On the other hand, handheld systems (equivalent in size to small laptop computers) are more powerful (faster processor and more storage) and are typically only available to leaders. The training plans described here are generic, yet reflect prototype software in different versions of dismounted Soldier systems such as the Land Warrior and Future Force Warrior systems, as well as capabilities in digital systems such as Force XXI Battle Command Brigade-and-Below (FBCB2), which is integrated in vehicular platforms. In this report, the wearable computer system is called a wearable computer and the handheld system is called a portable computer. More generically both are called a Soldier computer when there is no distinction made in the report regarding the intended user or the software on these two computer platforms.

Training plans for two sets of skills are presented. The first is a set of individual skills related to map functions. The second plan is for the collective task, conduct a passage of lines as a stationary unit. A passage of lines is an operation in which a force moves forward or rearward through another force's combat positions with the intention of moving into or out of contact with the enemy. This plan focuses on the actions that must be taken by individuals at different echelons to execute this task.

The training plan for map functions describes the functions themselves and how the functions provide an enhanced battlefield capability. It also specifies the prerequisite skills required by Soldiers before being trained on the map functions. The map skills that must be trained on the Soldier's computer system are described, along with critical teaching points for each function. This background information is followed by a suggested training plan on how to conduct the training itself. This includes assessing Soldier status on prerequisite skills, followed by comparative training exercises designed to have Soldiers apply the skill or execute a task using manual techniques with paper maps and to have Soldiers do the same skill or task using digital maps on their computer system. The training progresses through a series of increasingly difficult tasks and exercises, with a field training exercise culminating the training. Performance assessment procedures are described.

The structure of the skill training plan for the collective task, passage of lines, is similar to that for map functions. How computer capabilities enhance the unit's ability to execute this task is presented. Prerequisite skills, both individual skills and collective tasks, are identified. Critical teaching points are cited. A training plan that integrates individual skills, tests these skills, and culminates in a unit field training exercise is presented.

MAP FUNCTIONS

Purpose

The new skills training plan described here provides recommendations for the training of skills, procedures, and techniques essential for Soldiers to employ common map function skills using a wearable computer. These skills include, but are not limited to terrain association, land navigation, and the manipulation of overlays. This training is designed to reinforce existing skills, and to introduce and develop new skills in map functions on the computer. The concepts and exercises cited here reflect ideal training conditions to achieve a relatively high level of skill. The trainer, based on professional military judgment and Soldiers' military experience, may find that selected exercises and instruction from the guidance provided here best meet the Soldiers' or the unit's training need.

This map functions training plan is to be used as part a larger training plan. As such, instruction concerning the computer's graphical user interface (GUI) and receiving orders and overlays via the computer's e-mail system must also be integrated in the training.[1]

Map Functions Capabilities

The Soldier's map functions provide navigational aids, tracking of selected units or Soldiers, and aids in monitoring the enemy situation. System settings provide for the maintenance of a common operating picture (COP) or, more precisely, a unit defined operating picture (UDOP). This will provide the Soldier tailored displays of selected maps, friendly, and enemy information. The map display provides the Soldier with a view of his area of operations (AO) at a standard scale. The Soldier may select a view of the map that associates the display with his position on the ground. Unit leaders can conduct more precise planning and insert visual aids, or create and disseminate an overlay of common military graphics. This will assist in navigation, control of movement, and facilitate coordinated unit maneuvers. Observing map information and using basic visual terrain association and analysis skills, unit leaders can plan and execute movement while maximizing the use of the military factors of terrain such as observation and fields of fire, cover and concealment, obstacles, key terrain, and avenues of approach. Associating topographic symbols, such as contour lines, unit leaders can determine the potential of a location for observation and fields of fire. Vegetation and contour symbols assist in determination and prediction of cover and concealment. Contour interval, swamps, or other water related symbols can assist in locating and assessing obstacles to movement. These factors assist in determining the key terrain and/or avenues of approach that best satisfy tactical positioning, movement/maneuver, or other mission requirements.

Enemy situation displays provide both correlated and timely dissemination and display of reported locations of known or probable enemy dispositions. This visual "red" or enemy COP permits movements to be made with reduced risk concerning enemy observation and direct fires. It can also allow analyses that will facilitate maneuvers which employ terrain factors advantageous to the unit and disadvantageous to the enemy.

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[1] This training plan uses conceptual use cases, menus, and graphics from the Future Force Warrior Program with a date of October 2004. Training for the skills, knowledge, and procedures required for the capabilities shown here can be adapted to similar, Soldier-centric, automated situational awareness (SA) or command and control, communications, computers and intelligence (C^4I) systems with similar capabilities and displays.

Information gained through displays provides awareness of the composition, disposition, and current activities of relevant friendly units. This knowledge helps to deconflict a unit's maneuver and fires, while reducing the risk of fratricide to adjacent or cooperating forces. Within the limits and constraints imposed by higher headquarters, Soldiers can adapt on the move, adjusting routes, schemes of maneuver, objectives, and/or employment of fires based on changes to the situation. This flexibility permits the rapid exploitation of evolving enemy weaknesses, synchronization of fires and maneuvers, and enhances the synergy of battlefield effects. Unit leaders can use maps to help them visualize their area of operations, area of interest, and area of influence. Unit leaders may achieve enhanced situational understanding by using their map capabilities to plan, brief, explain, rehearse, and/or visualize steps or expected actions of the operation; and monitor/supervise the execution of the mission.

Prerequisite Map Skills

Map reading, terrain association, land navigation, symbols, overlays, distance determination, and azimuth measurements are essential as foundation skills for the map functions. Personnel receiving new map functions training must be able to perform the tasks and subtasks shown in Table 1. All Soldier tasks are individual training tasks as indicated by the ten-digit number identifying the task (Department of the Army [DA], 2003c, 2003d). Familiarity with the graphic user interface on the Soldier system being trained is also required.

Table 1
Prerequisite Individual Tasks and Skills for Map Functions

Individual Tasks	**Reference**
071-329-1006 Navigate from one point on the ground to another while dismounted	STP 21-1-SMCT
071-329-1019 Use a map overlay	STP 21-24-SMCT
Navigate Knowledge and Skills	**Reference**
Select a movement route using a map	Task 071-329-1006, STP 21-1-SMCT
Identify topographic symbols on a military map	Subtask 1
Identify terrain features on a map	Subtask 2
Determine the grid coordinates of a point on a military map	Subtask 3
Determine a magnetic azimuth using a lensatic compass	Subtask 4
Determine the elevation of a point on the ground using a map	Subtask 5
Determine the location on the ground using terrain association	Subtask 6
Measure distances on a map	Subtask 7
Convert azimuths	Subtask 8
Orient a map using a lensatic compass	Subtask 9
Orient a map using terrain association	Subtask 10
Locate an unknown point using intersection	Subtask 11
Locate an unknown point using resection	Subtask 12
Determine direction without a compass	Subtask 13
Determine azimuths using a protractor	Subtask 14
Compute back azimuths	Subtask 15

Note. STP = Soldier Training Publication; SMCT = Soldier's Manual of Common Tasks

Exploiting Map Functions Capabilities

To fully exploit the map function capabilities, the Soldier must exercise previously trained and developed skills, as well as develop new skills. As indicated in the prerequisite skills section, map reading, terrain association, land navigation, symbols, overlays, distance determination, and azimuth measurements are essential as foundation skills. Map functions assist the Soldier with navigation in unfamiliar terrain. Map functions also help unit leaders plan and visualize tactical operations, control maneuver and fires, update maps with single symbols or overlays, monitor movements, and maintain situational understanding of the ever changing battlefield situation. Map functions will also give the Soldier better situation awareness by locating and tracking movement of his unit and adjacent or cooperating blue forces, enemy situational understanding, and detection of changes to the situation. The Soldier, be he rifleman or platoon leader, must be familiar with the displays, menus, and functions available in order to maximize the effectiveness of the computer software and increase the combat power of the unit.

Skills Required to Exploit/Use/Employ the New Capabilities

The default or main view setting on the software display shows the main map and associated Situational Awareness (SA) (icons, overlays, etc.).[2] Figure 1 depicts the main menu. To access the map functions from the main menu the Soldier selects "Map". The map menu shows five functions. The functions are Adjust, Locate, Overlays (which include symbols), Routes, and Analyze. Figure 2 depicts the map menu functions. Each of these five functions and their subfunctions is described below. Teaching points for each function are also presented.

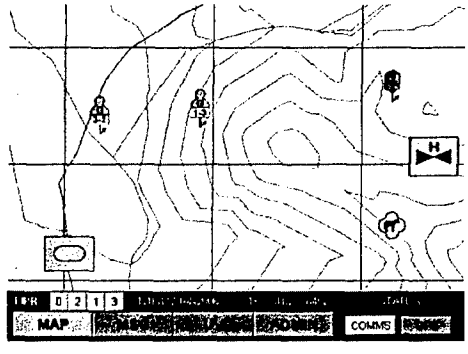

Figure 1. Main menu interface.

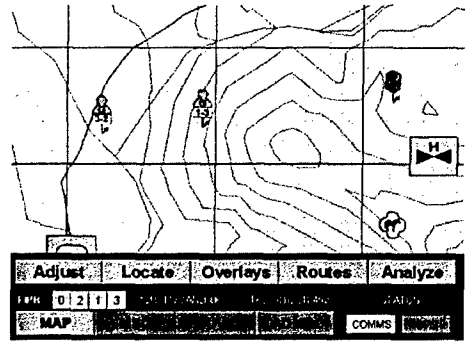

Figure 2. Map menu functions.

The Adjust Function

Selection of the "Adjust" button of map functions provides the Soldier with access to six capabilities: zoom in/zoom out, center map on self, determine one's own location, rotate the map, select maps (to include imagery), and adjust overlay size.

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[2] Specific displays and buttons are presented here. But the critical factors are the map functional capabilities themselves, as different interface designs could be used for the same critical functions. The displays presented here are simply used to illustrate and clarify how a Soldier might interface with map function capabilities. In addition, the functions described here can differ from what will exist on future, fielded Soldier systems.

Zoom In and Zoom Out

The Soldier can use the Zoom In/Zoom Out symbol buttons to incrementally zoom in or out.

Center Map on Self

The Soldier can find coordinates for his position by using the "center map on self" function. This centers the map on the Soldier's (grenadier) own icon, as depicted in Figure 3. If Soldiers wants to know their location without centering the map on their icon, they could use the 10-digit grid coordinate shown in the top tool bar display. The system (Universal Traverse Mercator (UTM) grid coordinates) provides location grid to within a 1-meter level of accuracy.

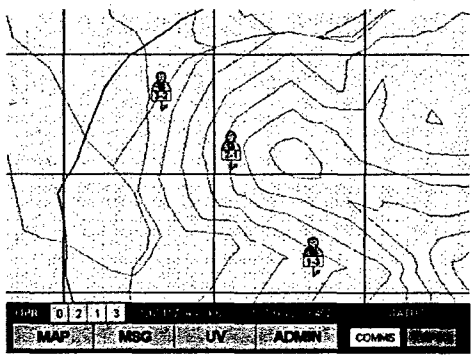

Figure 3. Map centered on Grenadier 2-1.

Rotate

The Soldier can choose to rotate the map with North up (default), or around himself (rotating the map around the user's direction of travel).

Select Maps, Imagery, or Displays

The Soldier can select from the maps and topographic products stored on his computer. These stored products provide the base or background for the SA displays and assist in developing an understanding of the tactical context of the situation by associating distance, direction, and associating events with terrain and the military aspects of terrain. Maps, including digital maps, are provided to the military by two primary sources. They are the Defense Mapping Agency (DMA) and the National Imagery and Mapping Agency (NIMA). Maps are generally broken down into four types. They are Digital Terrain Elevation Data (DTED), Compressed Arc Digitized Raster Graphic (CADRG), Vector Map (VMAP), and imagery.

DTED maps are generated by satellite borne radar. The first generation of DTED maps is now referred to as DTED 0, and provides a gross representation of the Earth's surface for modeling and assessment activities. The entire DTED process was developed for another Federal agency by NIMA. The first generation was deemed insufficiently detailed for military use. As a result DTED 1 mapping was developed and presents better resolution, which is within an accuracy of 100 meters to the actual ground. DTED 1 maps are usually found in 1:250,000 scale maps, although they may be used for 1:50,000 scale maps. DTED 2 maps, which give an accuracy of 30 meters has been developed. This effort to map the Earth using this technology

is scheduled to be performed as part of the Space Shuttle Program. Since the Space Shuttle Columbia accident, however; this program has been delayed. It will be able to provide accurate 1:50,000 scale maps. The advantage of DTED maps is the ability to quickly translate radar data to digital map data and the fact that they represent true elevation. True elevation is critical to the analytic function that the computer software performs in line of sight and circular line of sight modes. DTED maps are true three-dimensional digital maps. Because DTED maps only present topographic data, any man made features must be added to the maps. This can generally be done by adding those layers from vector maps, which will be discussed later.

CADRG maps will be the most common map Soldiers will work with in digital form. Put simply, paper maps in non-digital form, have been digitally scanned and rasterized so that they will "fit" into a computer system. Rasterization means that the graphic image is purely pixels with no mathematical formula used in creating them, thus using less memory. This helps keep the maps to a manageable file size. They cannot be altered or manipulated, only made larger or smaller in the display. CADRG maps generally come in two scales: 1:25,000 (known as ARC8) and 1:50,000 (known as ARC7), which makes them perfect for tactical use.

VMAPs, unlike CADRG maps, can be manipulated. A VMAP is generally made up of five to ten layers, and the layers can be made to become invisible or visible through mapping programs that may or may not be mounted on the Soldier computer. The layers are usually designed to show vegetation, drainage systems, population densities, and so forth that allow personnel to perform analysis concerning the terrain. One other feature of VMAPs that could be useful to the Soldier are the contour shading overlays that give the map in the digital display a three-dimensional appearance as shown in Figure 4.

Figure 4. A sample of a VMAP with contour shading.

Imagery is simply that – overhead photography either taken by satellite or other military aviation assets, such as the TR-1 (formerly known as the U-2). While imagery can be used by itself, it can also be combined with VMAPs to create what is known as an orthotopo map. This is essentially an overhead image with contour lines and grid reference markers added as a layer. A sample of an orthotopo map is shown in Figure 5.

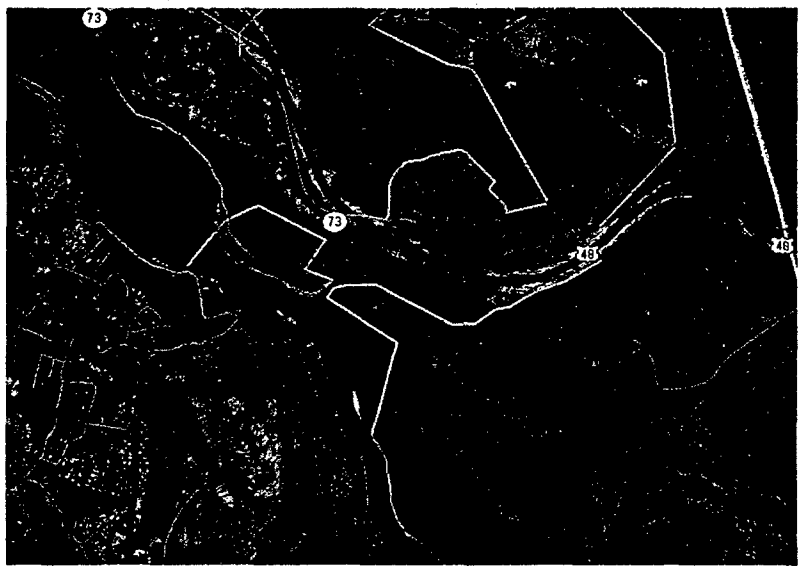

Figure 5. A sample of a vector orthotopo map with imagery and topographic features with contour shading. (The lines represent roads with differing capabilities.)

The last option available with maps is to show no map (None). This clears the background, so that the Soldier may just view any overlays that may be on the map without any interference from maps or other visual distracters.

Adjust Overlay Size

The Soldier can adjust the size of the symbols or the thickness of overlay lines with this function. The menu is depicted in Figure 6. This feature is available in the Adjust mode. Since it is a display adjustment, and only affects the Soldier's display; it does not affect overlays as displayed on other team members' displays.

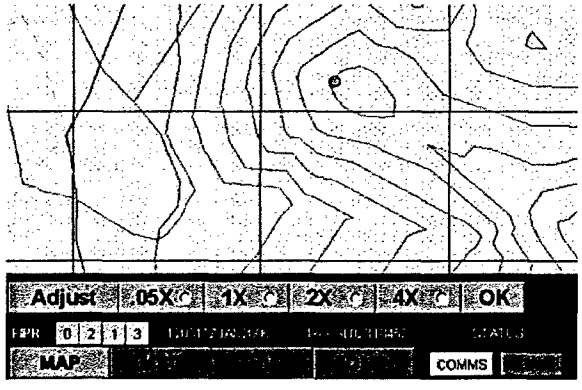

Figure 6. Adjust overlay size menu.

Teaching Points for the Adjust Function

Listed below are the primary considerations for adjustment of the display. The mission and tactical situation may dictate that some display adjustments may be more essential than others. However, the Soldier must develop proficiency in all aspects of display adjustment. The Soldier will normally select adjustment settings that will be of benefit to his SA through out the mission or that will be beneficial throughout a phase of the mission. When, or if, adjustments are made, the Soldier must be sufficiently proficient concerning display adjustments to preclude them from becoming a distracter during the primary mission or task.

Zoom and Map Scale Adjustments

Zoom and map scale adjustments are used to bring the map or image to a scale suitable for the Soldier's task and mission. In a close combat environment, for example in urban operations, the Soldier may need to select a scale that provides the distinct display of each member of his fire team and squad. The map or display scale of 1:10,000 or larger (1:8,000 or 1:5,000) may be required to provide the needed details of buddy and team locations when walls separate Soldiers. The Soldier would need to efficiently zoom in as his unit enters the built-up area. In more open terrain, the Soldier may zoom out to a scale that accommodates a larger view of his area of operations. He could use the standard of double the effective range of his weapon or the major weapons of his squad for a standard. Smaller scales of 1:12,500 or 1:25,000 may prove useful to the Soldier. His buddy, team, or squad may be easily identifiable and his attention may be focused on fratricide avoidance or enemy movements and targets. Leaders may find that even smaller scales are required to execute the coordination of movement or the maneuver of forces. Scales of 1:50,000 or 1:100,000 may be suitable for platoon, company, or battalion operations. Rapid transition to large scale maps and images may be required to confirm aspects of force link up, obstacle breaches or bypass, passage of lines, and/or to view problem areas and assess the situation.

Center Map on Self

Center Map on Self can be used to quickly recover from looking at other parts of the AO or from tracking another entity (see Enable Tracking below). The center capability provides the Soldier with an immediate view of his AO, regardless of scale or zoom, with the Soldier's representative icon in the center of the display. The Soldier's grid location is always displayed in the top information bar. The Soldier should use the tool for reorientation and to quickly find his location. He should learn to rapidly orient on the terrain, members of his unit, or nearby friendly forces, and determine if a change of scale (zoom in or out) is required.

Rotate

Rotate provides the Soldier the ability to observe the terrain display in the normal view, north up - east to the right, or permit the map to rotate with the top always in his direction of movement or body orientation. He may choose the view that best supports his awareness based on his current activity or situation. Maps and other topographic products and operations graphics are normally designed to permit easy reading of name labels and many topographic symbols with the map in the normal view. The symbols for swamps and power line towers are normally viewed upright and are easier to identify when viewed in the normal view. Place names such as cities and towns are also easier to read when in the normal view. When moving on patrols or when manning observation posts (OPs), the Soldier may associate terrain more readily when the map display is oriented in the Soldier's direction of travel or body orientation. It

will be quicker to associate events observed on the terrain with their location on the map, if the display is oriented in the direction of the observer's eyes and body. As with Center Map on Self, changes to map orientation may require an adjustment of scale (zoom) to enhance SA.

Selecting Maps, Imagery, or Display Background

Selecting maps, imagery, or display background is a critical element of SA. Soldiers and leaders should be aware of the advantages of various display backgrounds. Maps or other topographic products will provide the best and most common display background. These products will facilitate terrain association for most situations.

However, maps do not always prove the most accurate resources since they are based on historical data and only updated periodically. For example, battle damage, forces of nature, construction, and development in and near populated areas can change the nature of the terrain. Buildings may now exist where maps depict fields or forests. Current imagery, when loaded in the system, can provide a valuable resource and depict the terrain as it is, not as it was.

Imagery can also provide details on built-up areas not available from most topographic products. The map may show the presence of buildings, streets, bridges, and underpasses/overpasses. Imagery can provide additional information on the building materials, stories, expected entrances, and windows. Imagery can also provide information on the number of lanes on a street (possible width) and the characteristics of bridges, overpasses, and underpasses.

If map and imagery are both available, then the leader may want to switch back and forth between the two to adequately assess the terrain. If available, orthotopo maps provide the best of both worlds, showing the topographic nature of the terrain, and imagery that shows the most recent development in man-made features, such as buildings and roads, on a single display.

Adjusting Overlay Size

Adjusting the overlay size permits variation of the size of graphic symbols and lines. Symbols are of great value to enhance command and control and understanding the concept of the operation. Symbols can sometimes, however, obscure map or imagery details. Varying the size of symbols can assist in viewing the details. Often by reducing the size of the symbol, details can be viewed without obstruction. On occasion, however, increasing the size of the symbol permits the user to view through the symbol. Soldiers should be aware of the applications for adjusting overlay size.

The Locate Function

The Locate function permits the Soldier to locate other Soldiers in his unit, other blue forces or assets, and to determine the nearest known enemy element. Also, this function enables the Soldier to track blue forces and assets once they are located or selected.

Locate Individual, Unit, Asset, or Known Nearest Enemy

The Soldier can find other blue force icons (individuals or units), assets, or known nearest enemy icons/entities as shown in Figure 7.

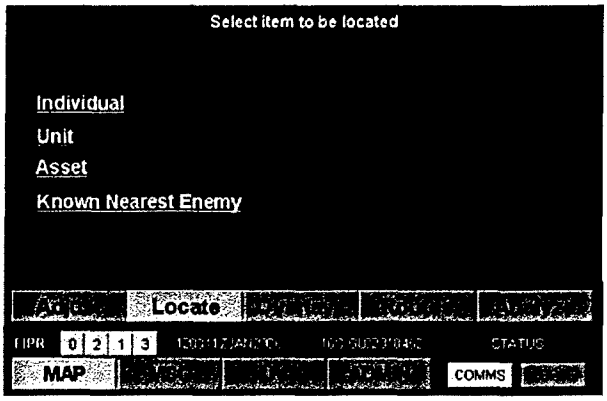

Figure 7. Locate menu.

Enable Tracking

After initial location of the item of interest, it can then be selected by enabling the track function (for individuals, units, and assets). The Soldier can center the display on the symbol for the selected entity or draw a line from the Soldier to the item. The track function will continue to follow that entity until the "Track" feature is turned off. The track option is not available for enemy tracking since enemy icons are displayed from a correlated database or are the result of a Spot Report.

Teaching Points for the Locate Function

Listed below are the primary considerations for use of the Locate function and tracking tool available with the display. The mission and tactical situation may dictate the use of the locate and tracking tools. However, the Soldier must develop proficiency in all aspects of the system location and tracking tools. The Soldier may choose to locate individuals, units or assets, or the nearest enemy force to enhance his SA. He may keep the display in the Center Map on Self mode or may choose to track the movement of leaders or other friendly units to be a guide during movements. When, or if, these tools are used, the Soldiers must be proficient to preclude the display or adjustments from distracting them from their primary mission or task.

Soldiers should be aware of the capabilities and limitations of the Locate tool. Locate Individual, Unit, Asset, or Nearest Enemy can be used to quickly find key leaders, a battle buddy, a crew served weapon (heavy machine gun, Javelin, etc.), an individual that might have critical breaching equipment, or his Infantry Combat Vehicle (ICV). The Soldier or leader may be able to locate individuals or resources in the fog of battle to direct their employment, recover items from an injured Soldier, or assist in moving key elements or individuals to a critical location. Locating the nearest enemy force can assist in assessing changes to the enemy situation, assessing the threat, or verifying that a nearby enemy unit has not been reported as having moved. While useful information can be obtained with this function, Soldiers should be aware that enemy locations in the SA display rely on combat information and reporting. The enemy force is not electronically tracked. Enemy units that have not been updated within the system may begin to fade from view after a specified period of time.

Enable tracking may be used to keep the SA display centered on a friendly individual, unit or asset as it moves about the battlefield. Tracking may be enabled for a friendly entity after it has been located. Tracking could be employed to follow a point man on a patrol, the lead element of an attack formation, the location of a key leader, or the guide at a passage point during a passage of lines.

The Overlays Function

To use the Overlays function the Soldier must be able to Add/Remove/Edit/Filter overlays and Add/Remove/Collapse symbols. Figure 8 depicts the selection of overlay types (Step 1, Figure 8) and Figure 9 depicts the action to be performed (Step 2, Figure 9).

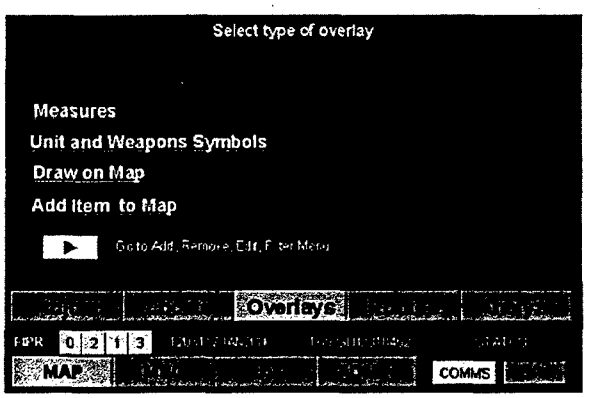

Figure 8. Type of overlay menu.

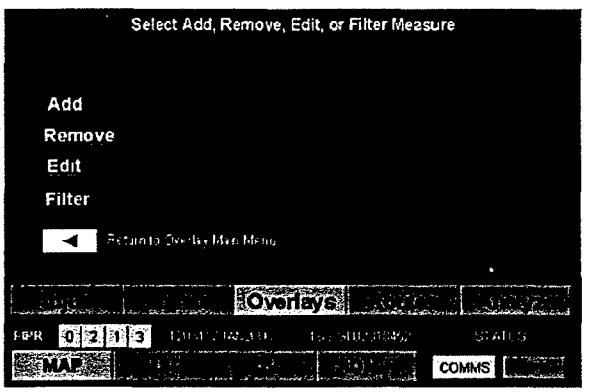

Figure 9. Overlays submenu selection.

Add

Add will let the Soldier place a symbol/overlay on the map. Labels can be added by the user.

Remove

Remove deletes a symbol/overlay that has been previously created and added to the display by the user.

Filter

Filter (overlays) lets the Soldier reduce screen clutter by filtering or "turning off" overlays. The overlays remain stored on the computer system, but are not visible until they are turned back on again.

Collapse

Collapse (symbols) lets the Soldier reduce screen clutter by collapsing symbols around the center of mass of the next higher echelon. For example, squads can be consolidated into their parent platoon icon or the Soldiers of a squad can be consolidated into their respective fire teams. Since the collapse of the symbol causes it to display at the point of the displayed unit's center of mass, the actual locations of subordinate elements are no longer depicted and details of dispositions will no longer be apparent.

Edit

Edit allows users to edit/change/modify overlays. This function can be performed by either by selecting an overlay/symbol displayed on the map or by selecting from a drop down list of overlays that are stored for display.

Teaching Points for the Overlays Function

The addition of a single military symbol or group of symbols (overlay) to the SA display can add context, understanding, focus, and intent to a military operation. Symbols can imply planned actions, indicate available resources, provide warning of a hazard, and impose controls to movements and fires. The overlay tools permit the Soldier or leader to create or modify/edit/remove symbols or the entire overlay to implement or eliminate controls or actions for himself or a subordinate individual or unit. Collapsing units or filtering off overlays permits the reduction of clutter or the temporary removal of details from the SA display. Editing or modifying the symbol or overlay can reduce or enhance details for future use.

During training, each teaching point must be addressed. The mission and tactical situation may dictate that some overlays or displays may be more essential than others. The Soldier must develop proficiency in the understanding and use of common symbol sets or symbols normally used in his unit and how to check the meanings of unfamiliar symbols. The Soldier will normally select for display the required overlay for the current operation. Leaders must be proficient in development of overlays to control fires and retain the ability to maneuver their elements. Soldiers are generally users and consumers of overlay information. When, or if, edits or adjustments to overlays are required, or when situations arise requiring the filtering or redisplay of overlays or collapsing or expanding of unit symbols, Soldiers must be proficient to preclude the display settings from distracting them from their primary mission or task.

The Routes Function

The Routes function permits the Soldier to create a route and plot the points of the route on a map. The Soldier has the option of selecting a current, new, or saved route or to select the option to load a route sent to him by his leader. As depicted in Figure 10, the Soldier selects the type of route function to be performed. For new routes, the Soldier can elect to use waypoints, cross country routes, preferred roads, avoid roads, and stealth as option sets for the route to be created. Figure 11 displays the route type selection menu: waypoints, cross country, preferred roads, avoid roads, and stealth.

The Waypoint option allows the Soldier to create his own route, waypoint by waypoint. As shown in Figures 10 and 11, Cross Country, Preferred Roads, Avoid Roads, and Stealth utilize some auto generation capabilities from the system. For these route types, users enter start time and end time (Figure 12) for selected points, and the system determines a route based on the type of route selected. Stealth, for example, performs terrain analysis, comparing friendly cover and concealment with enemy observation and fields of fire. It then recommends routes that offer the least chance of enemy detection. Cross Country generates a route using the most direct means possible from the selected start point to the selected destination point. Preferred Roads allows leaders or Soldiers to select the types of roads between the two points that they are willing to use. Avoid Roads will allow leaders and Soldiers to avoid all roads, or select the type of roads they wish to avoid. For example, a squad leader may be willing to use dirt roads and trails, but not improved roads, so he would select improved roads as the type to avoid. The difference between Preferred Roads and Avoid Roads is that the leader or Soldier

may select road segments they prefer, or road segments they want to avoid. For example, the squad leader may want to avoid a particular segment of a road in route selection, so he can mark it as an "avoid road" segment. As the system generates the route, it will plan the route to bypass that particular segment. The same can be done for Preferred Roads, where the leader may mark a segment of road he wants to use.

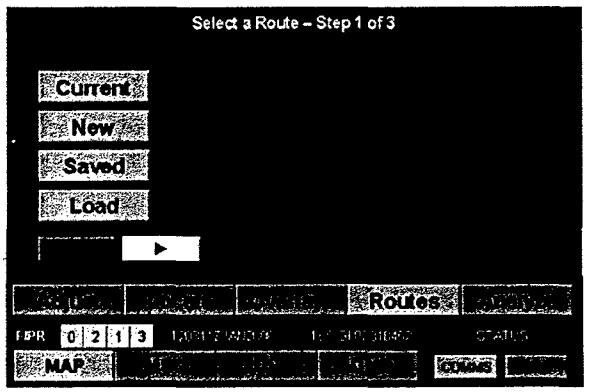

Figure 10. Route submenu selection.

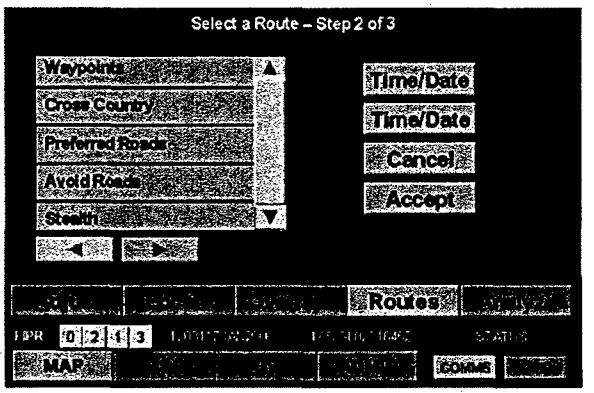

Figure 11. Route type selection menu.

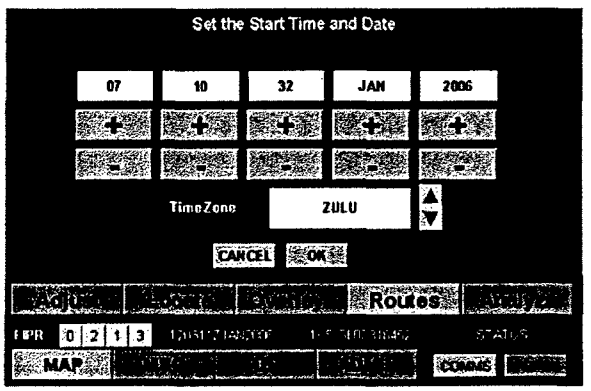

Figure 12. Start and end times for the route.

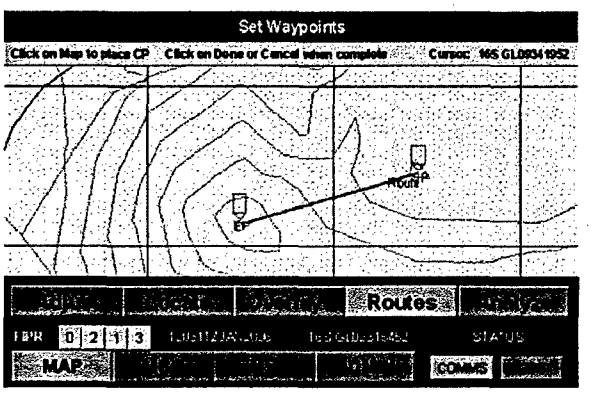

Figure 13. Waypoints used to create the route.

Teaching Points for the Routes Function

A number of teaching points apply to the route tools. Waypoint designated routes are user defined. Map inspection or knowledge from prior reconnaissance may be used to select the waypoints that define the route. The other means of route determination (Cross Country, Preferred Roads, Avoid Roads, and Stealth) require the user to identify the start point (SP) and start time, as well as, the end point (EP) and time to complete the route. The system uses 3-D digital maps to conduct aspects of the analysis required to determine, compute, and display the route.

Without compatible 3-D Digital maps, such as DTED 1 maps, accurate routes cannot be determined. The routes determined and displayed by the system are "recommended" routes based on the data available from the 3-D map database. Incomplete or missing data or information or data outside of system or database tolerances can make the route erroneous. For example, if the elevation data for the map is based on a 20-meter contour interval, as it frequently is for mountainous regions with sharply contrasting local relief, the map database may not reflect a 15-meter vertical drop along a streambed. Stealth route selection also depends on an accurate enemy situation depicted in the display. While the physical

characteristics of a designated route will seldom change, the locations of enemy forces and the enemy situation could change significantly from the time the route was analyzed. Reanalysis of the route and/or monitoring of changes may be required prior to execution of movement or maneuver to assure movement can be made undetected. The need for flank, point, and rear security are not negated by selection of a stealth route. Additionally, routes will be depicted graphically and follow a series of geometric points. These points may not follow the actual trace of a winding mountain road or the contours of a hill or valley. The route, even when fully supported by a high definition terrain database, is a recommendation of a general axis of movement, not a defined path.

The mission and tactical situation may require a leader or Soldier to determine a route based on automated route analysis and system defined parameters. Proficiency in the use of the tool and an understanding of the capabilities and limitations of the system are necessary in determining a route recommendation. When, or if, computer-determined routes are to be used (if this capability exists on the Soldier system), leaders and Soldiers must be proficient to preclude the display or adjustments from distracting him from his primary mission or task. Leaders and Soldiers, given the limitations of the products provided, must be able to analyze the system generated route on their own to determine if it is indeed both safe and effective.

The Analyze Map Function

The Analyze map function provides a visual display of circular line of sight from a determined point to a circular distance or range. It can also enable the determination of the line of sight and distance between two (2) selected points based on elevation, relief, and measured/computed distance between the selected points.

Circular Line of Sight

The Soldier selects a point on the map and a range or distance (weapon range or planning range for or a sensor or surveillance device). The computer calculates and displays a circle showing the visible line of sight area and the blocked or occluded area around the point to the pre-defined range/distance, as depicted in Figure 14.

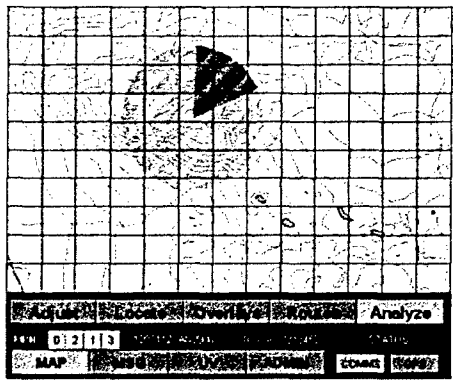

Figure 14. Circular line of sight diagram.

Line of Sight

The Soldier selects two points on the map to conduct the Line of Sight analysis or to determine distance. The system computes the distance between points and displays a graph

depicting a probable line of sight path between the points and the location(s) along the line that may be obscured by local relief, hills, valleys, or depressions. The graph is depicted in Figure 13. The horizontal line in Figure 15 that looks like railroad tracks is the distance in meters from the initial point to the destination point. The vertical railroad tracks represent an interval distance that the user has defined to help assist in performing both line of sight and distance measurement. Therefore, when terrain or forestation blocks the view, users can determine at what range they can no longer see. Given that information, users can best plan for indirect or plunging direct fire to cover the area, dependent on the range.

There are inherent limitations to typical line of sight tools that can represent a significant problem. First, they usually determine line of sight from two meters above ground level at the initiation point. Therefore it assumes that the Soldier is in the standing position. So if a Soldier were to be on top of a building or in a fighting position, the difference in height is not taken into consideration. Second, neither line of sight tool takes vegetation into consideration. Therefore if trees or scrub brush are between the initial point and the point(s) to be viewed, those are not taken into consideration, either. Both of these factors could have a major impact on the results obtained using these tools.

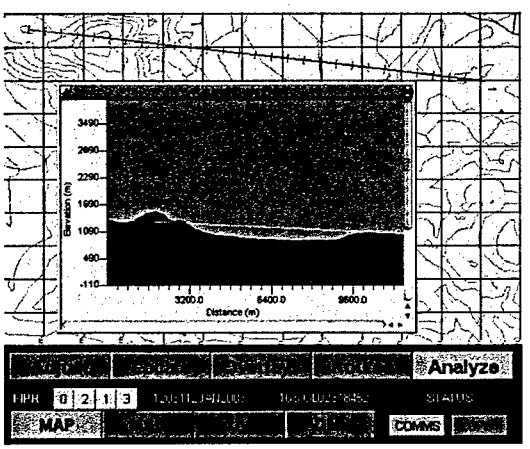

Figure 15. Line of sight diagram.

Distance

The Soldier selects two points on the map and the system computes their distance. This is the same tool used for line of sight. However, only the distance measure data is used.

Teaching Points for the Analyze Function

Listed below are the primary considerations for use of the circular line of sight and line of sight tools. The decision for selection of defensive positions, support by fire positions, OPs, and other locations that require good observation and/or fields of fire can be assisted with the circular and line of sight analysis tools. Soldiers and leaders can also determine the ability of enemy forces at known, suspected, or possible locations to see and engage friendly forces.

It is necessary to remind Soldiers and leaders that the circular and line of sight tools are only tools and are affected by vegetation and the initial height limitation of the software. Ultimately reconnaissance information is necessary to make final decisions. This does not make these tools useless. They serve their purpose in helping to narrow the focus of ground reconnaissance for position selection. A plot showing a clear line of sight to an area may still

require some adjustment and improvement of the position and clearing of fire lanes. The system uses 3-D digital map data (associated with DTED 1 maps) to conduct aspects of the analysis required to determine, compute, and display the line of sight information. Without compatible 3-D Digital maps, accurate information cannot be determined. Incomplete or missing data or information or data outside of system or database tolerances can make the line of sight displays erroneous. For example, if the elevation data for the map is based on a 20-meter contour interval, as it frequently is for mountainous regions with sharply contrasting local relief, the map database may not reflect observation and direct fire dead space associated with a steeper 15-meter vertical drop along a streambed. The mission and tactical situation may require a Soldier or leader to determine a line of sight from or to a specific location to assist in position selection and/or targeting. The Soldier must develop sufficient proficiency in the use of the tools and understand the capabilities and limitations of the system in determining line of sight.

Circular line of sight can be used to quickly assess the potential of observation and fields of fire from a location. These calculations and displays can assist in weapons position selection, route, or attack axis selection. Such use can help take advantage of dead space, triggering of fires on the enemy during an attack, or selection of a site for a security OP. The Soldier or leader should understand that actual conditions, natural, and manmade objects may negate some anticipated observation and fields of fire. Accuracy of the display depends heavily on the accuracy, completeness, and perimeters of the map database. Reconnaissance is always required to determine the specific details of capabilities. The tool provides support to planning and tactical decision making.

Line of sight (and distance) can be used to quickly assess the potential of observation and fields of fire from one location along a line to another location. These calculations and displays can assist in weapons position selection, evaluation of specific points along a route or attack axis to take advantage of dead space. The line of sight tool can also be used to determine the triggering of fires on the enemy during an attack, or selection of a site for observation of a specific area such as a named area of interest (NAI). The Soldier or leader should understand actual conditions and natural and manmade objects may negate some anticipated observation and fields of fire along the line to the point of interest. As with the circular line of sight tool, accuracy of the display depends heavily on the accuracy, completeness, and perimeters of the map database. Reconnaissance is always required to determine the specific details of capabilities. The distance calculation depends on the accuracy of the locations provided; however, the measured distance from the identified points will be accurate for planning. The tool provides support to planning and tactical decision making.

Conduct of Map Functions Training

Map training is designed for instructional adaptability dependent on Soldier/student class composition. For example, if personnel in the class have mastered Force XXI Battle Command, Brigade and Below (FBCB2), then the instruction and exercises described here will focus on training the differences between FBCB2 functions and Soldier computer functions. These personnel will be placed directly into a special track of advanced training. The identified tasks (see summary of tasks and skills to be trained below) and the application of the capabilities will be related to tactical situations and missions needed for mastering the map functions. Training will include an assessment of prerequisite skills via a pretest. The training is organized into three distinct periods; introduction, intermediate, and advanced. Each begins with instruction and terminates with practical exercises.

Summary of Tasks and Skills to Be Trained

The following tasks are required to **adjust** the map.

- Zoom In/ Zoom Out
- Center map on self; locate self on map, photographs, or imagery
- Rotate map, photographs, or imagery; orient a map from an OP
- Select the appropriate maps, photographs, or imagery based on situation
- Adjust symbol size
- Know when to use these features and why

The following tasks are required to **locate icons** on the map.

- Locate blue forces, assets, and individuals on map
- Locate known nearest enemy
- Enable blue force tracking
- Know when to use these features and why

The following tasks are required to **use overlays and symbols** on the map.

- Add/Remove/Edit/ Filter an overlay
- Add/Remove/ determine when to collapse symbols

The following tasks are required to **analyze** the map.

- Identify topographic symbols on photographs, or imagery
- Identify terrain features on photographs, or imagery
- Determine distance to and elevation of a point on a map, photographs, or imagery
- Perform a circular line of sight analysis
- Perform a line of sight analysis
- Determine when to use the circular line of sight feature to position an OP that permits observation of multiple Named Areas of Interest (NAI)

The following tasks are required to **create a route** on the map.

- Create a route using the map analysis tools
    - Avoid known enemy locations
    - Maximize covered and concealed routes
- Create a route using waypoints
- Digitally plot a point
- Determine start and end points for a route
- Determine and enter start and end times

Prerequisite Skills Evaluation

Prerequisite skills in map reading and navigation are essential to understanding the operation and use of map functions. Each Soldier and leader attending this training will be administered a pretest on the prerequisite skills listed at the beginning of this document. Pretesting and remedial training are a means to ensure that all Soldiers and leaders meet a common standard. This ensures the most efficient instruction is possible for all Soldiers and leaders. This training evaluation will be conducted in a classroom, on a desktop computer and delivered through interactive multimedia instruction (IMI). IMI is proposed as it is quick and standardized means of assessing skills. The evaluation will be an interactive pretest on the prerequisite skills. The pretest provides a performance assessment of Soldier and leader skills in map reading, map symbology, and overlays. Those who do not meet the standards will be given self-paced IMI on the prerequisite skills in which they were found deficient.

Since Soldiers and leaders should have had prior training on the graphic user interface (GUI) of the computer display, a pretest will be given on the GUI. This is to ensure they do not become lost in the introductory phase of training. This test will also be administered using IMI. It should be a performance-oriented test requiring Soldiers and leaders to be trained to use the GUI to access programs and perform functions. Those who do not meet the standards for GUI knowledge and skills may either be recycled to that phase of training in the overall program, or they may receive self-paced IMI.

Those Soldiers and leaders who claim to have training and experience in FBCB2 will be given an additional pretest on FBCB2 skills that mirror the summary of tasks to be trained on FBCB2. Those who do not meet the requisite standards will attend regular training. Those who meet or exceed the standard will be placed straight into the advanced training portion of map functions instruction and exercises.

Comparative Instruction and Training

Throughout the training program for map functions, instructors should use comparisons of how a function is performed manually with paper maps and then on the Soldier computer using digital maps. This serves two functions. First, it refreshes Soldiers on how to perform manual map functions, and it allows them to relate to the digital map functions more clearly. It continually proves to Soldiers the value added that the computer provides. Second, it reinforces non-digital skills, so that if a system goes down during operations, Soldiers are able to use non-digital map skills to accomplish the mission. The first three tasks are listed below showing methods of comparison that may be used for those skills. These should not be done in one block of instruction, but rather as an introduction to each skill in the introductory phase of training and each new skill presented in the intermediate phase of training.

The following are recommendations or suggestions on how to use comparative training to introduce the lessons. Instructors should not be limited to this list, but are encouraged to use creativity to motivate and challenge the class.

Adjust the Map

- Zoom In/ Zoom Out – Show Soldiers and leaders different scales of paper maps. Use 1:6250, 1:25,000, 1:50,000, 1:250,000. and 1:1,000,000 scale maps.

- Center map on self; locate self on map, photographs, or imagery – There is no replication of center the map on yourself when a computer system is not available. However, point out a location that they can find on all five maps (do not use grid coordinates) listed above and have them locate that point using grid coordinates. For the scales listed above they should use 10, 8, 6, 4, and 2 digit coordinates respectively.

- Rotate map, photographs, or imagery; orient a map from an OP – Have the Soldiers and leaders orient the map using a compass and then have them orient it using terrain features (ideally things like water towers, churches, and schools so that a more precise orientation and plot can be determined) posted on the walls in the classroom. Preferred map scale for this comparative exercise is either 1:25,000 or 1:50,000. Then have the Soldiers and leaders determine their location based on doing a back azimuth from those terrain features. This will give them their "position"

on the map. A note of caution – be sure to plot each Soldier/leader desk or location before class in the classroom, as they will all be different.

- Select the appropriate maps, photographs, or imagery based on situation – Have the Soldiers and leaders match their maps and imagery of terrain that appears on the maps. Imagery should have no reference marks, such as tick marks, grid lines, etc.

- Adjust symbol size – There is no replication on paper maps to adjust symbol sizes, other than redrawing them on the overlay. That will come in a later class.

Locate Icons on the Map

- Locate blue forces, assets, and individuals on map – Give the Soldiers and leaders a sheet of acetate and a list of blue force (BLUFOR) locations, types of units, assets, and individuals in 8 digit grid coordinates using the Military Grid Reference System (MGRS) and have them plot these features.

- Locate known nearest enemy – Give the Soldiers and leaders a sheet of acetate and a list of opposing force (OPFOR) locations, types of units, assets, and individuals in 8 digit grid coordinates using the MGRS and have them plot them. Have them determine which unit is the closest to their location.

- Enable tracking – Give the Soldiers and leaders a list of call signs that relate to a tactical situation. Play a tape of radio calls that is about 15 to 20 minutes long that is fast moving (offense) and have them plot the units as they move on an overlay. At the end of the tape have them show or compare where each unit in the tactical situation showed up. Include OPFOR as well.

Use Overlays and Symbols on the Map

- Add/Remove/Edit/ Filter an overlay – Give the Soldiers and leaders a tactical situation that portrays a unit getting ready to go over from the defense to the offense with all the pertinent graphics and unit symbols and individual symbols (for a platoon) on a 1:25,000 scale map. Also give them an engineer overlay, a chemical overlay with persistent and non-persistent chemical agents deployed and the contaminated areas, a fire support overlay, and a modified combined obstacle overlay (MCOO) (different from the engineer overlay in that a MCOO shows natural obstacles). Have them place all the overlays on the map.

- Add/Remove/ determine when to collapse a symbol – Using the same tactical situation as above and the same map, give the Soldiers and leaders sector sketches with all platoon positions for three platoons. Have them place the overlay of the sector sketches on their map. Do not let them remove any overlays with the possible exception of the maneuver overlay.

Analyze the Map

- Identify topographic symbols on photographs, or imagery – Without a legend on the paper map, circle symbols on the map and have the class identify what they are. Do the same with imagery that matches a map.

- Identify terrain features on photographs, or imagery – Circle at least seven distinct terrain features on the paper map and have the class identify each feature.

- Determine distance to and elevation of a point on a map, photographs, or imagery – Have the class check at least five to ten distances and also report the elevations at selected locations using a paper map.

- Perform a line of sight analysis– Have the class perform contour profiling using paper maps. Using imagery and the map have them determine if they can see a certain point on the ground.

- Perform a circular line of sight analysis – Have the class perform a contour profile to the four cardinal directions and the four primary intercardinal directions. This exercise should make them appreciate the circular line of sight tool. If there is time left during the exercise period, have them also perform a contour profile to the eight secondary intercardinal directions.

Create a Route on the Map

- Create a route using the map analysis tools – Create a tactical situation on a paper map with an overlay that contains friendly positions, enemy positions down to squad level, a friendly minefield with the clear lanes identified, and a reconnaissance objective. Give the class a reconnaissance patrol mission. Have the class perform an analysis that accomplishes the below listed goals and tasks. They will need to use contour profiling to determine if the enemy can see their patrol. Have selected members of the class brief their routes and why they selected their particular routes.
    - Avoid known enemy locations
    - Maximize covered and concealed routes

- Create a route using waypoints – Using a paper map, have the class create a route using waypoints to get from one point to another. Plotting the route in urban areas makes it more difficult.

- Digitally plot a point – While this cannot be done on a paper map, give the class a list of MGRS grid coordinates and have them plot them on the map. The various points given to the class should be a good route through the terrain that maximizes cover and concealment.

- Determine start and end points for a route – Have the class select an SP and rally point (RP) on the route they just plotted above.

- Determine and enter start and end times – Give the class march speeds and intervals and have them determine what the SP and RP times are.

Introductory Training

Introductory instruction should consist of the first three tasks, adjust a map, locate icons on the map, and use overlays and symbols, in that order. These are the most simple of the five tasks they are required to master in this portion of training. All Soldiers and leaders should have satisfactorily completed pretesting for map reading skills and the GUI or the remedial training for those skills. Instruction and practical exercise will be divided into the following blocks of

instruction. All training and exercises for these three skills are to be conducted in the classroom using desktop computers with Soldier computer software loaded. The Soldiers and leaders will use desktop computers loaded with this software and a global positioning system (GPS) stimulator. The GPS stimulator should provide them with input that a regular GPS device would give them. It can be designed similar to the GPS stimulator that FBCB2 uses in the Close Combat Tactical Trainer (CCTT) to support simulations. The instructor, when discussing or demonstrating activities will use a desktop loaded with the software and a Proxima, InFocus, or other similar display device to show the entire class the procedures involved.

Adjust the Map

Zoom in/zoom out. Class will begin with the comparative training of using different map scales. The Soldiers and leaders will then go to their desktop computers. The instructor will demonstrate the zoom in/zoom out feature and then have the Soldiers and leaders use the zoom in/zoom out feature as a practical exercise.

Center map on self; locate self on map, photographs, or imagery. Class will begin with the Soldiers and leaders performing a practical exercise in locating and plotting a variety of BLUFOR and OPFOR positions on an overlay on a paper map. The instructor will then discuss and demonstrate the center map on self capability and have the Soldiers and leaders perform that task. Once they have satisfactorily demonstrated their ability to perform the task, the instructor will demonstrate how to select a unit symbol and post it to the digital map. He will then have the Soldiers and leaders perform the same task they had using the map on the desktops using the Soldier computer software and GUI and digital map.

Rotate map, photographs, or imagery; orient a map from an OP. Class will begin with a comparative exercise in orienting the map and then locating themselves on imagery using both the paper map and paper image. Once all the Soldiers and leaders have satisfactorily completed this exercise, the instructor will discuss and demonstrate how to rotate the map within the software, and how to orient the map from a fixed location such as an observation post.

Select the appropriate maps, photographs, or imagery. Soldiers and leaders will use several different scale maps of the same terrain and imagery that correlate to that terrain. Soldiers and leaders will then determine what the imagery covers on the various maps. Once this is completed, the instructor will discuss and demonstrate selecting maps and imagery for integration into the display. Soldiers and leaders will then perform the same exercise with the GUI as they did non-digitally.

Adjust symbol size. The only comparative task similar to this non-digitally is to redraw the symbols on a new overlay. Rather than actually do this, the instructor will explain it, and then discuss and demonstrate how to adjust symbol sizes. Once this is complete the Soldiers and leaders will be given an exercise to complete that causes them to have to adjust some, but not all, the symbols sizes.

Post test. A post test will be given upon completion on the Adjust the map instruction and exercises. The post test should be IMI and based on emulations of the Soldier computer software, requiring the Soldiers and leaders to select the proper procedures to accomplish the task. None of the non-digital tasks should be tested, only digital tasks.

Remediation. For those who do not satisfactorily complete the post test, the needed remediation should be provided via self-paced IMI, on a CD-ROM (compact disc-read only memory) with a built in learning management system or on the Internet.

Timing of the instruction. Instruction on "when" to use these features should be covered in the Intermediate phase of training.

Sustainment. Sustainment training should be covered upon completion of all training, introductory through advanced. Embedded training, if developed, could sustain skills.

Locate Icons on the Map

Locate blue forces, assets, and individuals on map. The Soldiers and leaders will begin with a sheet of acetate and lists of BLUFOR locations, types of units, assets, and individuals in 8-digit grid coordinates using the MGRS and plot them as their comparative introduction. Once they complete this exercise, the instructor will discuss and demonstrate how to locate units using the search and the mouse over feature to locate and identify units. They will then be given a list of units by designation (i.e., 1st Platoon, Company C, 1st Battalion 22d Infantry), no MGRS grid locations, and a new tactical situation (different from the non-digital exercise). They must locate the units on the map and report the units' MGRS grid locations using ten-digit coordinates (within ten meters on the ground).

Locate known nearest enemy. The Soldiers and leaders will begin with a sheet of acetate and lists of OPFOR locations, types of units, assets, and individuals in 8-digit grid coordinates using the MGRS and plot them as their comparative introduction. Once they complete this exercise, the instructor will discuss and demonstrate how to locate units using the search and the mouse over feature to locate and identify units. Individuals will then be given a list of OPFOR units by type and designation if known, no MGRS grid locations, and a new tactical situation (different from the non-digital exercise). They will be required to locate the units on the map and report the units' MGRS grid locations using ten-digit coordinates (within ten meters on the ground). They will then be required to determine which is the closest to their location on the digital map.

Enable tracking. The instructor will conduct the comparative training and require the Soldiers and leaders to be trained to complete the 15-20 minute battle tracking exercise. They will then reveal where they have plotted their units, including both BLUFOR and OPFOR units. The instructor will then discuss and demonstrate how to turn on the BLUFOR tracker, the merits of the capability, and then the Soldiers and leaders will go through the same exercise, using only digital equipment, so that they can see how much easier it is to track units using this feature. At the end of the digital exercise, they will compare their completed digital tracking results with the non-digital results. This should be a real eye-opener for them.

Post test. A post test will be given upon completion of locate icons on the map instruction and exercises. The post test should be IMI and based on emulations of the software, requiring the Soldiers and leaders to select the proper procedures to accomplish the task. None of the non-digital tasks should be tested, only digital tasks.

Remediation: For those who do not satisfactorily complete the post test, the required remediation should be provided via self-paced IMI, either on a CD-ROM with a built in learning management system or on the Internet.

Timing of the instruction. Instruction on "when" to use these features should be covered in the Intermediate phase of training.

Sustainment. Sustainment training should be covered upon completion of all training, introductory through advanced, and be available as embedded training.

Use Overlays and Symbols on the Map

Add/remove/edit/filter an overlay. The instructor will give the Soldiers and leaders the comparative exercise in overlays as indicated above and allow them to complete the exercise. The instructor should then get the class' impression of the readability and usefulness of these combined overlays. The instructor will discuss and demonstrate how to use both e-mail and the Data Transfer Device/Mission Data Loader (DTD/MDL). Following the demonstration the Soldiers and leaders will download each of the overlays they used during the non-digital comparative exercise. Once they have satisfactorily downloaded the overlays, the instructor will discuss and demonstrate how to add them to the digital map. The class will then add their maneuver overlay (only the maneuver overlay at this point) to the map. Following adding the maneuver overlay, the instructor will discuss and demonstrate how to edit an overlay and will change two of the units on the overlay. The class will perform the same exercise. Upon successfully editing the maneuver overlay the class will add/display the remaining overlays. The instructor should have them compare the non-digital map they posted to the digital map with overlays. The readability and usefulness should be approximately the same.

The instructor will discuss and demonstrate how to filter non-essential information so that the overlays are more useful and readable. The instructor and the class will discuss in depth which information is essential and which is non-essential and why according to the tactical situation. The class will then be required to filter their overlays accordingly. Based on the tactical situation (changing from the defense to an offense), the instructor will tell them that once they pass the line of departure they no longer need to display the MCOO or the obstacle overlays. He will demonstrate how this is done within the computer software, and then have the class do the same. Once this is complete, the instructor will give them a new tactical situation and have them repeat the process with less coaching.

Add/remove/determine when to collapse symbols. The instructor will conduct comparative training using the same tactical situation as above and the same map, give the Soldiers and leaders sector sketches with all platoon positions for three platoons. The instructor will have them place the non-digital overlay of the sector sketches on their paper map. He will not let them remove any overlays. The instructor will bring to their attention the amount of clutter on the map. This will introduce the ability to add, remove, and collapse symbols. He will discuss each and then demonstrate collapsing symbols until the map becomes clearer. He will then have the class do the same. Once this is complete, the instructor will have them remove all the overlays with the exception of the maneuver overlay. This will be an exercise that should require no coaching, since the class learned how to do this during previous instruction. Once all the overlays are removed, he will discuss and demonstrate adding four or five different types of symbols, both for BLUFOR and OPFOR (4-5 each). The class will then add four or five symbols each to the digital map for both BLUFOR and OPFOR. Once each Soldier or leader has added these symbols, the instructor will discuss and demonstrate removing each of the symbols the class just added. Upon completion of the demonstration, the class will remove the symbols they just added.

Post test. A post test will be given upon completion of use overlays and symbols on a map instruction and exercises. The post test should be IMI and based on emulations of the software, requiring the Soldiers and leaders to select the proper procedures to accomplish the task. None of the non-digital tasks should be tested, only digital tasks.

Remediation: For those who do not satisfactorily complete the post test, remediation in the areas where they did not meet standards should be provided via self-paced IMI, either on a CD-ROM with a built-in learning management system, or on the Internet.

Timing of the instruction. Instruction on "when" to use these features should be covered in the Intermediate phase of training.

Sustainment. Sustainment training should be covered upon completion of all training, introductory through advanced, and be available as embedded training.

Intermediate Training

Intermediate training will consist of reinforcement training for the three major tasks taught in introductory training, and will add two new tasks. These tasks are more complex than the first three. The tasks are analyze a map and create a route. It is necessary to teach analyze a map before creating a route, so that Soldiers and leaders can perform an analysis of the terrain using the line of sight and circular line of sight tools while determining a route in support of a tactical mission. Prior to each class the instructor will give the class instructions to perform one of the three major tasks previously learned. The instructor will monitor the Soldiers' and leaders' progress in these tasks.

Initial training will be conducted in a classroom using desktop computers with software loaded and an input system to stimulate GPS readings and generate icon movement. This can be a device similar to that found for FBCB2 as previously mentioned. Once the basics are taught and practiced, the Soldiers and leaders will be issued an actual Soldier system, and training will continue in the field to practice those skills learned to this point.

Initial Map Functions

Conduct an open discussion with the Soldiers and leaders as to when the following map capabilities would be used. Encourage individual participation. As an alternate means of teaching this portion of the class, the Soldiers and leaders could be divided into groups for group discussion. Have each group make its own list on butcher paper, and when all groups are completed, have each group brief when and why these capabilities would be used.

- Zoom In/ Zoom Out.
- Center map on self; locate self on map, photographs, or imagery
- Rotate map, photographs, or imagery; orient a map from an OP
- Select the appropriate maps, photographs, or imagery based on situation
- Adjust symbol size
- Locate blue forces, assets, and individuals on map
- Locate known nearest enemy
- Enable blue force tracking
- Add/Remove/Edit/ Filter an overlay
- Add/Remove/ determine when to collapse a symbol

Analyze the Map

Identify topographic symbols on photographs or on imagery. Without a legend on the paper map, circle symbols on the map which the class must identify. The class will do the same with imagery that matches a map, Once the comparative session is complete the class will be given the same task with the computer, except that they will be told to locate and report the MGRS grid coordinates for items such as a church, a swamp, a water tower, a radio tower, and so forth. The class will also be told to import photos and locate those same items on imagery.

Identify terrain features on photographs or on imagery. Prepare maps for each of the Soldiers and leaders, circling at least seven distinct terrain features (saddles, draws, depressions, valley, cliffs, ridges, and hills) on the paper map and have the class members identify each feature. On the computer, have the class download and load an overlay that uses a different area of terrain. The overlay will have selected terrain features circled, and the members of the class must identify those terrain features using IMI that is running simultaneously with the software.

Determine distance to and elevation of a point on a map, photographs, or imagery. Have the class check at least five to ten distances and also report the elevations at selected locations using a paper map. Once they have completed the comparative exercise, discuss and demonstrate how to determine a distance and elevation using the software. Then have the class members perform at least ten distance and elevation checks on the map displayed in their GUI. Discuss why this is an important feature of the next task, line of sight analysis. Also discuss situations where determining a distance and elevations might be important, such as during an attack, the conduct of the defense, and tactical foot marches.

Perform a line of sight analysis. The class will perform contour profiling using paper maps. Using imagery and the map, have them determine if they can see a certain point on the ground. Once they have completed the comparative exercise, discuss and demonstrate how to conduct a line of sight analysis. Then have the class do five non-tactical line of sight analyses. Discuss when a line of sight analysis would be useful in a tactical situation, such as a non-illuminated non-supported night attack, for positioning weapons in a defense, planning for a reconnaissance mission, and for establishing an OP or ensuring line of sight for selected communications systems. Give the class three tactical situations where they would need to determine line of sight and have them determine if the tactical situation is supportable with the current line of sight analysis.

Perform a circular line of sight analysis. Have the class perform a contour profile to the four cardinal directions and the four primary intercardinal directions. This exercise should make them appreciate the circular line of sight tool. Upon completion of the comparative exercises, discuss and demonstrate how to perform a circular line of sight analysis. Have the class perform three circular line of sights using the software. After they complete their first analysis, open a short discussion on the observed differences and ease with which they can perform this analysis using the computer software as compared to the manual method. Explain the uses for the circular line of sight analysis tool and when they would use it, such as selecting observation post sites, determining dead space and fields of fire for crew served weapons, and estimating if there are routes into an enemy position where BLUFOR might not be seen or detected.

Post test. A post test will be given upon completion of analyze a map instruction and exercises. The post test should be IMI and based on emulations of the software, requiring the Soldiers and leaders to select the proper procedures to accomplish the task. None of the non-digital tasks should be tested, only digital tasks.

Remediation. For those who do not satisfactorily complete the post test, remediation in the areas where they did not meet standards should be provided via self-paced IMI, either on a CD-ROM with a built in learning management system, or on the Internet.

Sustainment. Sustainment training should be covered upon completion of all training, introductory through advanced, and be available as embedded training.

Create a Route on the Map

Digitally plot a point. While this task cannot be done on a paper map, give the class a list of MGRS grid coordinates and have them plot them on the map. The various points given the class should be a good route through the terrain that maximizes cover and concealment. Once they have completed this exercise, discuss and demonstrate how to plot a point on the map using the software. Then have them plot the same points using the software on the digital map. This must be the first class they receive prior to any of the following training.

Create a route using waypoints. Using a paper map, have the class create a route using waypoints to get from one point to another. Plotting the route in urban areas makes it more difficult. Upon completion of the comparative exercise, give the class a set of waypoints using MGRS grid coordinates for a cross country route that takes them through an urban area and have them plot the route.

Create a route using the map analysis tools. Create a tactical situation on a paper map with an overlay that contains friendly positions, enemy positions down to squad level, a friendly minefield with the clear lanes identified, and a reconnaissance objective. Give the class a reconnaissance patrol mission. Have the class perform an analysis that avoids enemy locations and maximizes the use of cover and concealment. They will need to use contour profiling to determine if the enemy can see their patrol. Have selected members of the class brief their routes and why they selected their particular routes. Once they have completed the comparative exercises, discuss and demonstrate how to use the map analysis tools to create a route. Upon completion of the demonstration, have the class plot at least two routes using a tactical situation where BLUFOR and OPFOR units are present on the overlay and they must select a route to rejoin the BLUFOR without being detected by OPFOR units.

Determine start and end points for a route. Have the class select an SP and RP on the route they just plotted above. This should be done on the paper map first and then have them plot it on the digital map using the software. No discussion, other than instructions, or demonstration should be required for this class since the individuals know how to plot a point on the map. They might require some assistance in labeling the point.

Determine and enter start and end times. Give the class march speeds and intervals and have them determine what the SP and RP times are on a paper map. Upon completion of the comparative exercise, give them a new tactical situation and have the plot the route using waypoints and then locate the SP and RP. Then have them calculate the start and end times for that route. Ideally, if time is available, they should do two to three routes and times,

Post test. A post test will be given upon completion of create a route on the map instruction and exercises. The post test should be IMI and based on emulations of the software, requiring the Soldiers and leaders to select the proper procedures to accomplish the task. None of the non-digital tasks should be tested, only digital tasks.

Remediation: For those who do not satisfactorily complete the post test, remediation in the areas where they did not meet standards should be provided via self-paced IMI, either on a CD-ROM with a built in learning management system, or on the Internet.

Sustainment. Sustainment training should be covered upon completion of all training, introductory through advanced, and be available as embedded training.

Intermediate Training Exercises I

All Soldiers will participate in a day and night land navigation course using the Soldier system. Skills to be emphasized are adjusting the map, locating icons on the map, using an overlay and plotting a route using waypoints. During this exercise all Soldiers will be required to navigate to a BLUFOR icon on the map, such as a parked Stryker or Bradley Fighting Vehicle. They must plot a route that takes them to a specified cache, where they will retrieve an object they have been instructed to pick up and return to the vehicle. Each Soldier should have at least two items to retrieve along the way, if not more. This will require them to use waypoints, zoom in and out, adjust symbol sizes, use BLUFOR tracking, and their waypoints and route should be plotted on an overlay that they forward to the instructor. To make the exercise more difficult, the instructor can have the vehicle move to a new location periodically to cause the Soldiers to track it.

Intermediate Training Exercises II

A second exercise will be conducted for all Soldiers that consists of a survival, escape, and evasion course. The exercise should have several BLUFOR vehicles and Soldiers positioned to represent a friendly position. Minefields and obstacles should also be in place. There should also be OPFOR that will remain stationary. Each Soldier will receive an overlay of the friendly forces, enemy forces, and an obstacle overlay. In order to achieve a "GO" for this exercise, the Soldiers must avoid enemy contact and make contact with the BLUFOR friendly unit. This will cause them to use all the skills they have learned in Map Functions. Soldiers to be trained should be employed as buddy teams. Each buddy team should undergo an after action review (AAR) at their completion of the exercise. Instructors should use the tracking system in FBCB2 and the Soldier system to monitor progress of the individual teams, which will help them during the AAR.

Advanced Training

Advanced training for map functions consists of two different tracks. The first track is designed specifically for those Soldiers and leaders who have had prior training and experience on FBCB2 and have tested out of training. The second track is designed for those Soldiers and leaders who have progressed through map functions training and are now ready for advanced training and concepts in the use of the computer. These two tracks can and will be conducted separately.

Advanced Training Track I

Soldiers and leaders with experience in FBCB2 and have "tested out" of introductory and intermediate training will attend Advanced Training Track I. Initial training for this group will consist of comparative training exercises using FBCB2 and then the Soldier system. The classrooms for this track should have surrogate FBCB2 and Soldier systems. The Soldiers and leaders will be subjected to a comparative training exercise on FBCB2 and then required to perform the same exercise using the computer software. Prior to each session with the Soldier system, the instructor will provide a discussion and demonstration of the differences between FBCB2 and the Soldier system software to accomplish each task.

As the culmination to this phase of training, Track I personnel will participate in a military stakes event, where they must plot and navigate to waypoints, which will be different stations. At each station each individual will be tested in a hands-on component of the tasks that are part of the curriculum of this course. Soldiers and leaders must receive a "GO" at each station in order to pass the course of instruction. Those who do not receive a "GO" will be retested later at the stations they did not satisfactorily complete.

The Soldiers and leaders who are assigned to this track, who received first time "GOs" at each station of the military stakes will complete the formal course of instruction much more quickly than those who will undergo normal progression in Track II. These personnel should, upon completion of their training, be assigned as coaches or mentors to those Soldiers and leaders who are experiencing difficulties learning the map functions. This should occur at approximately the same time as the Track II personnel are advancing into intermediate training.

Advanced Training Track II

Soldiers and leaders who have progressed through the Map Functions training will undergo more field-oriented training, practicing the skills they have learned in tactical scenarios. This group will attend a field training exercise where they will have to accomplish the tasks presented below.

Track II personnel will establish a defense, and create overlays that show defensive positions for platoon and below, to include the locations of crew served weapons such as the M240 machinegun, the Javelin, and the mortar. They must use the circular line of sight tool to determine fields of fire and observation from those positions and adjust them accordingly. Once on the ground the Soldiers and leaders can see what the limitations of the circular line of sight tool are, such as not taking into consideration vegetation, nor the depth of a fighting position. They must also establish locations for observations posts, using the circular line of sight tool.

Personnel will also move by tactical foot march to a location on the map, avoiding posted enemy locations. This will require the use of the line of sight tool, the distance tool, and the circular line of sight tool. They will also have to use the zoom in and out feature to get more detail and exact locations of other members of the platoon and squad, and they will have to use the rotate and orient digital map features as they navigate through the terrain.

As the culmination to this phase of training, Track II personnel will participate in a military stakes event, where they must plot and navigate to waypoints, which will be different stations. At each station each individual will be tested in a hands-on component of the tasks that are part of the curriculum of this course. Soldiers and leaders must receive a "GO" at each station in

order to pass the course of instruction. Those who do not receive a "GO" will be retested later at the stations they did not satisfactorily complete.

Culminating Field Training Exercises

Upon completion of the entire course of instruction on the Soldier computer, there will be a culminating field training exercise in which all Soldiers and leaders will participate. This field training exercise must have tasks from map functions training incorporated into the exercise. This is where it will all "come together" for those who have participated in the training. An example of such a vignette would be executing an approach to an objective and establishing a fire support position, which would involve determining the best route given intelligence on the enemy, determining the fire support position through line of sight tools, issuing orders that require estimating the time to the objective given the planned route, encounter of an unexpected man-made obstacle that would require a change to the route, and so on. Conduct of this vignette at night would provide the greatest challenge to the individuals being trained.

Safety

Prior to training in the classroom, Soldiers and leaders should be given a briefing on electrical safety and actions to take in the event of an electrocution. For field training, leaders/trainers will coordinate the mode of evacuation of casualties through the appropriate channels and review all installation safety regulations. Unit leaders and/or trainers will determine, brief, and enforce all safety regulations established by local range control. Unit leaders and/or trainers must complete a thorough terrain reconnaissance before using an area for land navigation training. They should look for dangerous terrain, heavy trafficked roads, water obstacles, wildlife, and training debris.

Sustainment and Embedded Training

Commanders and leaders must ensure that map functions are seamlessly incorporated into all field training and sustainment training. Platoon leaders, with external assistance, can plan and schedule training similar to the military stakes events mentioned in Advanced Training. Embedded training can also be used to sustain Soldiers and leaders within the platoon, accomplishing two goals. First is the sustainment of skills. Second is to reduce the reliance on embedded training and embedded information when the platoon is in "the thick" of battle, be it simulated or real.

Conclusions

The map functions provide tools to enable the Soldiers and leaders to attain and sustain improved SA. Map functions can also improve overall efficiency in planning and the execution of a variety of missions. Soldiers must become proficient in the operation and use of these tools and capabilities to permit the system to contribute to their SA and the accomplishment of the mission.

CONDUCT A PASSAGE OF LINES AS THE STATIONARY UNIT USING DIGITAL OVERLAYS

Purpose

The training plan provides recommendations for the training of skills, procedures, and techniques essential for leaders to use digital overlays with a wearable and a portable computer. This training plan and the training exercises are designed to reinforce existing skills, introduce and develop the new skills, and develop a level of proficiency in the use of overlays and enhance SA during the following task: ***conduct of a passage of lines as the stationary unit.*** These skills apply to both the forward and rearward passage of lines. This training can be conducted at the institutional level, by a new equipment training team (NETT), and at the unit level. Ideally, initial training using this plan should be conducted by the NETT with sustainment training conducted by the unit.

This training plan is to be used as part a larger training plan. For example, Soldiers must receive instruction on the GUI and how to receive orders and overlays via the e-mail system or data transfer device/mission data loader (DTD/MDL) prior to training in the use of overlays during the conduct of a passage of lines as the stationary unit. [3]

Computer Passage of Lines Capabilities

The wearable computer system provides enhanced lethality and survivability for the small Infantry unit. One of the most dangerous tasks a unit can perform is a passage of lines as either the passing or passed (stationary) unit. Both units are likely to be in contact with the enemy and under enemy pressure. Both units have a great potential for inflicting fratricide casualties on each other or themselves in the heat and confusion of battle. A passage of lines as a stationary unit requires detailed and comprehensive planning, coordination, and execution. The more information that lower level units have concerning the passage of lines, the less likely that fratricide and confusion will occur.

The Soldier system with the wearable computer has the capability to allow the Soldier and leader to see other members of the unit, the enemy, and the map on which they are operating. It allows them to communicate with other members of the squad and platoon, and to see operational graphics that pertain to the mission. The portable computer used by the leader has software that allows the leader to plan missions, rehearse missions, test various courses of action that are open to the unit, and help in the conduct of after action reviews. While other functions can be executed with these computers, these capabilities are the ones that are pertinent to a unit planning and preparing for a passage of lines as the stationary unit.

Prerequisite Skills for Passage of Lines

Personnel receiving training on using an overlay and conducting a passage of lines as the stationary unit with a computer system must possess the skills and knowledge presented in Table 2. Seven-digit numbers indicate a collective task and ten-digit numbers indicate an individual task (DA, 2002, 2003a-d, 2004a-b).

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[3] Training for the skills, knowledge, and procedures required for the capabilities shown here can be adapted to similar, Soldier-centric, automated SA or C^4I systems with similar capabilities and displays.

Table 2
Prerequisite Individual Tasks and Skills, and Collective Tasks for Passage of Lines

Collective Tasks	**Reference**
07-3-1108 Conduct a passage of lines as the stationary unit	ARTEP 7-5 MTP
07-3-1270 Conduct tactical movement	ARTEP 7-5 MTP
07-3-2054 Report tactical information	ARTEP 7-5 MTP
07-3-3009 Employ fire support	ARTEP 7-5 MTP
07-3-5000 Conduct a rehearsal	ARTEP 7-5 MTP
07-3-5036 Conduct troop leading procedures	ARTEP 7-5 MTP
07-3-5027 Conduct risk management	ARTEP 7-5 MTP
07-3-1081 Conduct a link up	ARTEP 7-5 MTP
07-3-1315 Employ protective obstacles	ARTEP 7-5 MTP
Individual Tasks, Skills and Knowledge	**References**
071-000-0005 Prepare a range card for a machine gun	FM 3-22.68
071-329-1019 Use an overlay	STP 21-24 SMCT
071-332-5000 Prepare an operations overlay	STP 21-24 SMCT
071-450-0030 Conduct a passage of lines	STP 7-11B24-SM-TG
071-710-0006 Plan use of night vision devices	STP 21-1-SMCT
113-571-1022 Perform voice communications	STP 21-1-SMCT
113-637-2001 Communicate via a tactical radio in a secure net	STP 21-1-SMCT
071-730-0014 Identify combat vehicles	STP 21-1-SMCT
301-371-1000 Report intelligence information	STP 21-1-SMCT
061-283-6003 Adjust indirect fire	STP 21-24 SMCT
071-326-5502 Issue a fragmentary order	STP 21-24 SMCT
071-326-5503 Issue a warning order	STP 21-24 SMCT
551-88N-0002 Prepare for unit move	STP 21-24 SMCT
551-88N-0003 Plan unit move	STP 21-24 SMCT
071-332-5021 Prepare a situation map	STP 21-24 SMCT
071-326-5775 Coordinate with an adjacent platoon	STP 21-24 SMCT
Prepare sector sketches	Appendix H, FM 3-21.71
Individual Digital Tasks, Skills, and Knowledge	**Reference**
XXX-XXX-XXXX Perform digital map functions	Not in current STP
XXX-XXX-XXXX Send a digital message	Not in current STP
XXX-XXX-XXXX Create a digital overlay	Not in current STP

Exploiting Overlay Capabilities in the Passage of Lines

To fully exploit these new capabilities, the Soldier must employ previously trained and developed skills, as well as new skills. As indicated in Table 2, previously acquired skills and knowledge in troop leading procedures, the ability to create range cards, sector sketches, and digital overlays are essential as foundation skills. Leaders must also have the previously acquired knowledge concerning non-digital passage of lines as the stationary unit, link ups, risk management, tactical movement, reporting tactical information, and planning and employing fire support and obstacles.

Individual Soldiers will have the capability to digitally construct an individual sector sketch/range card. For example, a Soldier may create his sector sketch and send it to his Team Leader who will incorporate it and create a team sector sketch. The Team Leader will send the

team sector sketch to the Squad Leader who consolidates both team sector sketches into a squad sector sketch and sends it to the Platoon Leader. The Platoon Leader consolidates all the squad sector sketches into a Platoon overlay and sends it to the Company Commander. This process continues up the line, creating a common operating picture (COP) for the passage of lines and providing a detailed diagram of engagement capabilities, dead space, target plans, obstacle plans, and passage lanes. This is a new capability which gives a more complete more accurate picture of the situation and capabilities of the unit to be passed.

Electronic overlays, such as the fire support overlay and obstacle overlay, allow a more rapid integration into the passing unit's plans than the old method of acetate overlays. Acetate overlays require physical transportation of the overlay from the platoon to company, which then consolidates all the platoon sector sketches or overlays. Then the company acetate overlays must be transported to battalion. These overlays are then consolidated with the overlays from the other companies and the battalion directed actions. Once this is complete, the battalion passage plan is transferred back to an acetate overlay and disseminated down to platoon level for both the passing and passed unit.

Digitization allows this sharing and dissemination process to happen in minutes where the old method can take hours or even days. Not only will the Soldiers and leaders who need the overlays be able to obtain them much more quickly and accurately, it is possible to use a mission planning and rehearsal tool to practice the execution of the plan. Leaders can ensure that the plan is workable and that everyone understands it. If it becomes necessary to modify a plan, that can be done quickly and efficiently. Once the plan is set, the final overlays can be disseminated in seconds to all participants.

With computer systems at the individual level, Soldiers and leaders have the capability to create overlays, or to edit overlays provided by higher headquarters based on local tactical requirements. All Soldiers have the option of viewing a single overlay or multiple overlays, increasing individual SA. Soldiers will no longer have to physically align and attach overlays to a map. The computer software automatically places overlays on the digital map to within one-meter of accuracy. All Soldiers have the capability of viewing overlays not just the leaders, thus, increasing the unit's SA. Soldiers can be made aware of the exact location of obstacles, breach points, passage points, and other critical locations.

Teaching Points for Passage of Lines as the Stationary Unit Using Digital Overlays (All Leaders, Platoon and Below)

Each leader of the stationary unit must know what critical information should be included on a digital overlay or the series of overlays sent to the passing unit. The information covered in this training is specific to those overlays the passing unit requires from the stationary or passed unit; rather than to the overall passage of lines. While a battalion may consolidate these overlays to create similar battalion overlays, it is important that overlays created at company and platoon level also be transmitted to the respective "sister" passing unit. In other words, platoons of the stationary unit send overlays to platoons of the passing unit. As a minimum, the stationary unit should transmit a maneuver overlay, an obstacle overlay, and a fire support overlay. Each is discussed next.

Maneuver Overlay

The maneuver overlay should show the locations of the passage points. A passage point should be wide enough for the passing unit to be able to maneuver. Generally, for an infantry platoon, a passage lane should be between 100 and 300 meters wide. When the terrain is more restrictive, then more passage lanes that are smaller need to be added and restricted to squads using these lanes. It can be assumed that a squad will move through the passage lane in a squad column, with fire teams in a wedge. This would generally require a passage lane that is 50 meters wide. The maneuver overlay should also depict the location and identification of the guides (i.e., Soldiers) who will guide the passing unit through the lane. These should be marked as contact points. With digital communications and GPS locations, it is not always necessary to have Soldiers as guides. Instead, the passing unit can be assisted by waypoints, designated by the stationary unit and depicted on the overlay. If guides are not used, the two units must work out the details of communications to convey when all passing units scheduled for each passage lane have completed their movement.

The maneuver overlay should include rally points for the passing unit both forward of and behind the stationary unit. Rally points should be mutually agreed upon by both units and be tactically sound. Rally points would be used in the event of contact that delays or inhibits the passage. Rally points should not be positioned or constituted to create a massed target, and should never be more than platoon sized.

If the passing unit will stop to reassemble in the rear of the stationary unit and within the stationary unit's area of operations and responsibility, then the stationary unit will also designate assembly areas in its rear area for the passing unit. If the unit is to pass through the stationary unit without stopping, then assembly areas are not necessary. Finally, the maneuver overlay should show the location of the command posts for both units and any start points, release points, and check points. Check points should be reported by the passing unit as they cross them.

The maneuver overlay must depict the battle handover line (BHL) and the expected time that transfer will occur. The BHL should be within individual weapon range of the stationary unit, with its final location agreed upon by both units. For a forward passage of lines, once the passing unit has received the stationary unit's maneuver and fire support overlays, the passing unit will designate defensible battle positions or attack positions as initial rally points (IRP) beyond the BHL.

Obstacle Overlay

The obstacle overlay must include as a minimum the precise location of the obstacles and lanes through or bypass routes around them. These lanes should be wide enough for a squad to pass through in a squad column formation with teams in a wedge, which is usually 50 meters wide depending on the terrain. The lanes should be marked prior to the initiation of the passage. These obstacle overlays should be generated by the stationary unit platoon leader or his engineer representative. Types of mines and obstacles should be indicated on the overlay. False minefields must also be annotated.

Upon completion of the passage and time permitting, the platoon leader should direct that at least some of the lanes that were used by the passing unit be closed for operational security reasons. Never should all lanes be closed. Obstacles are to block or canalize the enemy, not friendly forces. Any fire planning or direct fire capabilities that are designed to

overwatch or further hinder the advance of enemy forces should also be included on the overlay. While this same information should be found on the fire plan overlay and maneuver overlay, it is sometimes best to integrate them into the obstacle overlay. It may be possible to filter the overlays to show just these items. Then the stationary unit should indicate to the passing unit which filters to use. The overlay or the order can be annotated with communications instructions to enable the passing unit to call for fires if necessary during the passage.

Fire Support Overlay

The fire support plan overlay is critical to the success of the passage of lines. It will be generated by the stationary unit, its fire support element, and the direct support artillery battalion. The fire support plan overlay should be a bottom up developed overlay with higher headquarters consolidating and approving target plans. All requested fires during the actual passage of lines will be fired by the stationary artillery and indirect fire units. Once it is completed and approved by the stationary unit's artillery and indirect fire unit commanders and leaders, it will be transmitted to the passing and stationary units. As a minimum, the fire support overlay will include the BHL, any restrictive fire lines (RFL), no fire areas (NFA), and free fire areas (FFA). In order to reduce the overall number of operational overlays with which the passing unit must work, air defense artillery positions and range data should be integrated with the fire support overlay.

Other Overlays

Other overlays that might be sent to the passing units could be modified combined obstacle overlays (MCOO), other pertinent intelligence preparation of the battlefield overlays, the enemy situation overlay, and modified combat service support overlays that show the locations of rearm and refuel points, medical evacuation and treatment facilities, and collection points such as enemy prisoner of war or maintenance collection points. The passing and stationary units must agree upon a time or a distance from the BHL where the passing unit becomes responsible for its own combat service support.

Simulations using a Portable Computer

Once the overlays have been created and disseminated, it may be possible for a leader to simulate a mission rehearsal using a mission planning and rehearsal tool. The tool may be a simulation with entities that possess artificial intelligence, giving them the ability to react as Soldiers would, both friendly and enemy. The OneSAF Objective System might be a good tool to use for this purpose, since it contains low to high resolution entities. High resolution entities react by evaluating terrain, the enemy, and the mission. Fatigue, time of day, visibility, and other similar factors affect their reactions. This capability, while not a completely accurate predictor of future actions, can give leaders a chance to test their plans and any courses of action that may have been developed. This will assist them in determining where any "chinks in their armor" may lie, or which course of action might have the best chance of success.

This capability will allow both the stationary and passing units to test their plans, and if necessary make modifications to them. If modifications are needed, they can be disseminated quickly to all participants, so everyone has the most current information.

Conduct of Overlay and Passage of Lines Training

Summary of Required Skills and Tasks

The skills presented here start with individual Soldier tasks and end with platoon leader tasks. At each higher echelon, the overlays must be consolidated and integrated for transmission to the next echelon.

- Create digital range cards for crew served weapons.
- Forward digital range cards
- Create a digital squad sector sketch and integrate the crew served weapons range cards.
- Forward digital sector sketches to the platoon leader by e-mail
- Create a digital platoon sector sketch or overlay integrating the squad sector sketches and range cards.
- Forward the digital platoon sector sketch or overlay
- Create a digital platoon overlay for the passage of lines as a stationary unit, including the following overlays:
    - Maneuver
    - Obstacle
    - Fire support
- Forward the platoon digital sector sketch and overlays to the company commander and the passing unit.

Overlay Training

Diagnostic Testing

Training will begin with a pretest of prerequisite skills to ensure everyone possesses the necessary skills. Soldiers will initially be given non-digital pretests on overlays, followed by training on common digital skills, and then training on specific overlays essential to the passage of lines. The training culminates with conducting a passage of lines in a field exercise with Soldiers and leader employing their digital systems to assist them in successfully completing this mission.

All Soldiers (including leaders at platoon and below) will be pretested (non-digital) on range cards and sector sketches. Leaders will be pretested on creating overlays and map symbols in accordance with FM 1-02 (DA, 2004a). For those Soldiers and leaders who are not able to achieve the standard for each skill, they must be given remedial training. This is best done using interactive multimedia instruction (IMI) so that they may receive training at their own pace and at a time and place that will not interfere with the classes. Pretesting may be done all at once at the beginning of instruction, or it may be done prior to each class. It is recommended that everyone be tested on all prerequisite skills prior to the conduct of any training in order to better understand the capabilities and limitations of the Soldiers and leaders to be trained.

Range cards and sector sketch pretesting should involve the evaluation of skills in creating a paper copy range card (DA Form 5517-R) and a paper-based sector sketch. This will ensure that the Soldiers to be trained understand the concepts and principles of those documents. This can best be performed by giving the Soldiers tactical situations presented in IMI, and having them create at least two range cards. The range cards must include the items listed in Table 3 (DA, 2003a).

Sector sketches can be done separately from range cards but in the same manner, presenting the Soldiers with a tactical situation and either paper-based or computer-based replicas of range cards. Those Soldiers who do not satisfactorily complete the pretest should be given remediation training in range cards and/or sector sketches using IMI. These would be purely non-digital diagnostic tests. Sector sketch skills should be similar to range card skills, less the data section.

Table 3
Requirements for Range Cards

Weapon symbol	Sector of fire
Principle direction of fire or final protective fire	Range, azimuth, and distance to targets
Dead space	Distance and azimuth from a known point
Magnetic north arrow	Data found in the data section of DA Form 5177-R

Overlay pretesting can be done using a computer-based diagnostic test to determine the level of knowledge concerning control measures, military symbology, and techniques. Techniques involves such things as placing a unit map symbol on an overlay, the use of reference marks (commonly referred to as "tick" marks), marginal data, classification and classification authorities, and creating an overlay from a list of control measures with MGRS locations. The pretest should also include minefields and artillery target reference points (TRPs) based on the unit tactical standing operating procedures. Upon completion of the pretest, Soldiers should have to create a paper overlay based on an operations order that has no overlay, only MGRS locations for all control measures, units, barriers, etc.

Those Soldiers who are not able to satisfactorily complete the first overlay diagnostic test (non-digital) should be required to complete remedial training using IMI, and then retested. If they are not able to demonstrate the ability to create non-digital overlays, they will not be able to adequately perform or understand subsequent lessons or perform properly on digital overlay diagnostic testing.

Ideally, the ultimate pretest for a unit is to conduct an Army Training and Evaluation Program (ARTEP) evaluation of the platoon(s) using checklists from ARTEP 7-5 MTP Tasks 07-3-1108 and 07-3-1099 (DA, 2003). This would involve a lot of training resources. The unit should concentrate on skills at the lower echelons and individual level prior to undergoing an ARTEP evaluation to maximize the training benefit to Soldiers and leaders.

Training on Digital Graphics and Control Measures

Requirement. Upon satisfactory completion of the non-digital overlay pretest by Soldiers and leaders, and of a passage of lines field exercise by the unit (if possible) without computer systems, a block of instruction focusing on common digital skills should be given. Core skills that must be trained are the ability to create and edit the control measures listed in Table 4 (DA, 2003d, 2004a).

Table 4
Digital Overlay Graphics and Control Measures to be Trained

Points	**Areas**	**Lines**
Target reference points with labels	Support by fire positions with labels	Planned routes and positions
Checkpoints with labels	Unit objectives with labels	Phase lines with labels
Contact points with labels	Obstacles with labels	Line of departure with labels
Coordination points	Assembly areas with labels	Unit boundaries with labels
Linkup points with labels	Attack positions with labels	Line of contact with labels
Passage points with labels		
		Arrows
Units		Axis of advance with labels
Unit symbols with labels		Direction of attack with labels
Enemy units with labels		Main attack versus supporting attack

Leaders/Soldiers must be trained on how to find the appropriate graphics, how to edit them (change size, orient appropriately on the map), to label them, to copy them, to move them, to delete them, and to incorporate them in an overlay. In addition, they must be trained on how to send the overlays to appropriate individuals within their chain of command. Leaders who must integrate more than one overlay, must be trained on how to copy overlays, integrate, and/or filter multiple overlays.

Training media. Training can be conducted in a classroom with networked desktop computers with system software. The network of computers must have a mail server to allow the Soldiers to transmit e-mail to one another. IMI can be used to present a series of pre-determined exercises that covers the required skills. Another approach would be for the instructor to demonstrate the procedures and skills using an overhead projection system, followed by the leaders practicing the same skills on their individual computer systems.

Target population. The attendant audience for this class should be all Soldiers and leaders who must contribute to the final passage of lines overlay. This includes gunners on crew served weapons, team leaders, squad leaders, weapon squad leaders, artillery fire support team members and leaders, combat engineers, platoon sergeants, and platoon leaders.

Method. Since individuals have already passed a non-digital pretest on graphic control measures, training will begin with instruction on where the symbol list/icons are found in the computer system. Individuals must understand the logic of how the symbols are organized and categorized in the symbol menu (icon library) as the pool of operational graphics (DA 2004a) is extremely large. It is important that they be able to quickly find the graphic control measures they will use.

This instruction should be followed by training on how to apply a symbol to a map, to size it, to orient it, to label it, to move it, to delete it, to copy it, and incorporate it in one of the overlays available on the computer system. Single point symbols should be trained first, followed by multi-point symbols. Soldiers and leaders should practice plotting at least five examples of a single point symbol and ten examples of a multi-point symbol. Practice exercises should include graphic orientation and labeling as well. Not all the graphic control measures cited in Table 4 need be covered in this basic instruction, as they will be trained during the appropriate overlay blocks of instruction.

Procedures for sending, copying and integrating overlays can be conducted using the symbols that have been plotted in the prior practice exercises. Other individuals in the class can be the recipients of the overlays, using them as the basis for the copy and integration instruction. If IMI is used as the means of training, then the training approach would be adapted as appropriate to that training technology.

Post test. The Post test will test Soldier skill in finding symbols quickly. It will also test Soldier skill in the basic functions related to plotting symbols: change size, orient, label, move, delete, and plot on the designated overlay. The test should ensure that a representative sample of symbols is included. The test could be totally computer-based or hands-on performance oriented testing.

Range Cards

Requirement. Soldiers and junior leaders will already possess the prerequisite skills of making range cards and sector sketches on paper. They also have basic skills associated with using the overlay tool software in the wearable computer and/or the portable computer, and how to forward the digital output to their team leader, squad leader, or platoon leader. The purpose of this block of instruction is on generating digital range cards and platoon sector sketches, and applying these skills in tactical scenarios.

Training media. Training can be conducted in a classroom with networked desktop computers with system software. The network of computers must have a mail server to allow the Soldiers to transmit e-mail to one another. The classroom desktop computers should also have a port compatible to the connection of actual DTD/MDLs to download range cards. Remediation for leaders failing to attain standards can be done using IMI and simulation software. The IMI should have frequent checks on learning to ensure the leaders are learning how to perform these tasks to standard. Remedial training must culminate in a post-test that is as difficult as the original post-test. The remediation should be structured in such a manner so that it can be included as sustainment training to refresh the more perishable skills and knowledges, and that it presents information that is particular to a passage of lines for the stationary unit.

Target population. The attendant audience for this class should be gunners on crew served weapons, team leaders, and squad leaders, since these are the personnel who will prepare and use range cards.

Method. The class will require two to three scenarios loaded into the software that portrays tactical situations on different terrain in which one platoon, as part of a larger unit, must pass through another platoon, also part of a larger unit. Soldiers will be instructed in the specific software procedures necessary for creating range cards. The methodology should be a demonstration followed by step-by-step instruction as the Soldiers actually create a digital range card. This can be done in the classroom with a Flash animation on their screens. The animation should have "VCR" play, pause, rewind, and fast forward controls to allow the Soldiers control of the demonstration if done on individual computers. Soldiers will then create two to three range cards for an M240 machinegun, an M249 squad automatic weapon, or an AT4 anti-tank launcher, depending on their assigned duties, using two to three different tactical scenarios. Ideally there should be at least two scenarios, one with the passing unit moving rearward, and another with the passing unit moving forward.

Soldiers and junior leaders will then be trained on the two methods of transmitting a digital range card to their team leaders. This will be done using both e-mail and the DTD/MDL. Soldiers will then use both methods in a practical exercise to send three messages with range cards) each way. Range cards can be the range cards the Soldiers and leaders developed in the first part of the class. A final situation will be presented to them where they send one range card by e-mail and one by using the DTD/MDL as an assessment of their ability to use these tools.

Post test. A final tactical scenario will be presented to the Soldiers to assess their skill at creating a digital range card for a squad automatic weapon or an M240 machinegun. Testing may be done using a combination of IMI and hands-on performance oriented testing.

Fire Team, Squad, and Platoon Sector Sketches

Requirement. Soldiers and leaders will already know how to create a digital range card at this point, but they must learn how to integrate the range cards with sector sketches for fire teams, squads, and platoons.

Training media. The Training media can be the same as that described under the Range Cards section, but it must allow for construction and transmission of sector sketches.

Target population. The attendant audience for this class should be team leaders, squad leaders, platoon sergeants, and platoon leaders, since these are the personnel who will prepare sector sketches.

Method. The method for training sector sketches parallels that for training range cards. The class will require two to three scenarios loaded into the software that portray tactical situations on different terrain in which one platoon, as part of a larger unit, must pass through another platoon, also part of a larger unit. Soldiers will be instructed in the use of the software and its procedures and sequencing to create sector sketches and to integrate the range cards they have been given for the class. The methodology should be a demonstration, via animation or an instructor, followed by step-by-step instruction as the Soldiers actually create a digital sector sketch. Soldiers will then create two to three sector sketches for a fire team, squad, and platoon. Ideally there should be at least two scenarios, one with the passing unit moving rearward, and another with the passing unit moving forward. Junior leaders will then be trained/refreshed on the two methods of transmitting a digital sector sketch to their leaders. This will be done using both e-mail and the DTD/MDL. They will then use both methods in a practical exercise to send three sector sketches each way. A final situation will be presented where they send one sector sketch by e-mail and one using the DTD/MDL as an assessment of their ability to use these tools.

Post test. A final tactical scenario will be presented to assess leader skill in integrating range cards to generate a sector sketch at the appropriate echelon command. The Post test will be tailored to the leader's echelon of command (fire team, squad, platoon). Testing may be done using a combination of IMI and hands-on performance-oriented testing.

Create a Digital Platoon Maneuver Overlay for a Passage of Lines as the Stationary Unit

Requirement. Leaders already know military symbols, how to create a paper overlay, how to create the basics of a digital overlay, how to attach it to a map, and how to transmit it using e-mail or the DTD/MDL. In this block of instruction, they must apply these skills to a

creating a maneuver overlay, as well as learning how to filter information that appears on the overlay and how to load, remove, and unload overlays.

Training media. Initially, the required skills should be taught in the classroom. Once a basic understanding is achieved, the instruction can move to a field location where engineer tape can be used to designate minefields, obstacles, passage lanes, initial rally points (IRPs), etc. Initially desktop computers can be used that are loaded with Soldier computer software for the overlay tool. When moved to a field location as described, each leader will require the actual Soldier system/ensemble and a leader's portable computer.

Target population. The audience for this class is the platoon leader, platoon sergeant, and weapons squad leader. Including squad leaders is optional --- at the unit's discretion.

Method. As necessary, instructors will review military symbology and graphic control measures, the use of the icon library, and how to select, deselect, and create custom symbols and graphic control measures for their overlays. See Table 4 for a list of required symbols and control measures. Several short practical exercises should be available if the instructor believes leaders need additional practice on these skills. Leaders will be instructed in the construction of a maneuver overlay in support of a passage of lines as the stationary unit, and will, during the course of two practical exercises, build a maneuver overlay. These discussions should form the basis of this instruction. Instructors will also teach how to use a MDL. As a practical exercise leaders will use an MDL to install and load several overlays. As follow on to MDL instruction, how to filter pertinent data will be the final block of instruction in this series of training on the digital overlay and maneuver overlay.

Maneuver overlay requirements to train. The maneuver overlay contains much detailed information. The class instructor should hand out a checklist for leaders that lists all the information that should be on a passage of lines maneuver overlay and the checklist should also be included as an embedded checklist that can be recalled if necessary. The instructor should also cover each of the following requirements for digital overlays used during the conduct of a passage of lines for the stationary unit.

Maneuver overlays at platoon level should contain, as a minimum, the location of each crew served weapon (this includes squad automatic weapons), the location of each squad leader, the location of the platoon command post (CP), and the location of the platoon sergeant if it is different from the platoon CP. For the passage of lines, the precise location of the lanes must be indicated. Lanes should be marked on the overlay with a start and end point, a width, and a length. If the passage is to be a forward passage of lines, the stationary unit should also indicate the route with a start point and a release point at the beginning of the passage lanes. If the passage is to be rearward, then the entry route should have start points that are beyond the maximum effective range of small arms fire. The release points should be at the beginning of any main supply route the passing unit has been directed to use by the stationary units higher headquarters. There should be sufficient lanes through obstacles to allow the unit to pass in a continuous effort without creating bottlenecks. Depending on the size of the unit to be passed, the enemy situation, obstacles, and lanes available through the obstacle lanes, a passage lane should be wide enough for a platoon to enter it and allow it to maneuver. Generally, for a platoon this will be 100-300 meters wide depending on visibility. If visibility is restricted, the narrower the lane should be. If there is heavy vegetation and good cover and concealment, the lane should be relatively narrow. If there is little to no vegetation and good visibility, the lane should be wider. If the passage lanes lead straight into an obstacle, actions should be taken to preclude a bottle neck between the passage lanes and the obstacle lanes.

One of two methods may be used to assist the passing unit through the passage lanes. The traditional method of using guides is one method. If this is to be the case, then the guides should be at posted contact points on the overlay with identification and recognition data included. It may not be necessary to use recognition signals if both units are equipped with either FBCB2 or the Soldier and leader computers. As a note of explanation, FBCB2 is the digital communications and mapping system found from company to brigade levels of command. While FBCB2 may be replaced by a more modern system under the Future Combat System, it will be referred to in this document as the system to which the leader computer will tie into at higher levels of command and control. Approaching identified icons or symbols should be sufficient. The less traditional but more advanced method is to provide the passing unit waypoints located at the middle of the passage and obstacle lanes with marginal data indicating the width of each lane left and right of the waypoint. There is no need for recognition signals. The passing unit platoon leader should inform the stationary platoon leader when his last unit has completed the passage, irrespective of which method of guiding the unit used.

Initial rally points and rally points should be posted to the overlay. The stationary unit will select these positions and post them to the maneuver overlay, since they are usually more familiar with the terrain. Rally points should be positioned before the passage, during the passage if possible, and after the passage as an assembly area. Rally points should be covered and concealed to provide the passing unit protection, and should also be defensible in the event enemy contact requires the passing unit to take cover and defend itself.

Finally, any contingency plans must accompany the maneuver overlay in the event of unavoidable contact with the enemy. Each step of the passage should be defined by phase lines, and each phase should have a contingency plan in the event of unexpected contact. These overlays should include engagement areas, battle positions, and supplement battle positions. At each phase, it is best if the two units compliment each other's firepower and capabilities, but as a minimum they should not interfere with the protection or safety of each other.

The classroom practical exercise should require leaders to create at least three maneuver overlays, based on tactical situations. The final maneuver overlay must be evaluated by instructors to determine if leaders are ready.

Post test. Each participant will be required to create a platoon maneuver overlay that meets all the requirements for a maneuver overlay depicting a passage of lines as a stationary unit. Part of the assessment can be done in the classroom as a computer-aided test to evaluate knowledge concerning symbols and graphic control measures, as well as the requirements for a maneuver overlay in support of a passage of lines as the stationary unit. If IMI is not available, they can transmit the overlay to the instructor as if he were the next higher headquarters. The final assessment will be conducted during the culminating field training exercise (FTX) or ARTEP.

Create a Digital Obstacle Overlay for the Passage of Lines as the Stationary Unit

Requirement. The purpose of this training is to enable participants to create an obstacle overlay for the passage of lines as the stationary unit.

Training media. Initial training will be conducted in a classroom using desktop computers loaded with the software. The class should move to a field location with the actual

Soldier/leader equipment and software once the basics have been established to mark passage lanes through minefields both manually and electronically.

Target population. The target audience is platoon leaders, platoon sergeants, and engineer squad leaders in support of infantry units.

Method. Training begins with a review, if necessary, of symbols and graphic control measures, and progresses to review of using the symbols and icon library to create overlays. This training is primarily for the benefit of the engineers but their infantry counterparts can help as coaches during the training. There should also be a review of obstacles and passage lanes using the more traditional paper method. This should then progress to creating an engineer overlay digitally. Participants should be given tactical situations in which they must develop a barrier plan and then determine what must be forwarded to the passing unit to enhance the passage of lines. The final portion of training should have the infantry and engineers working outside on a field that is approximately 400 meters by 400 meters. Barriers should be emplaced. Then the participants create a digital obstacle overlay with passage lanes, and forward it to the next higher headquarters via the MDL. Once this is done, the passing unit will walk through a passage of lines either forward or rearward using the digital overlay created by the platoon leader of the stationary unit using their situational awareness displays on their computer systems. To maximize training, the stationary and passing units can switch at the completion of a passage.

Obstacle overlay requirements to train. Obstacles include both barriers to movement and minefields. Some minefields can be false minefields, but should still be treated as active minefields for operational security reasons.

Obstacle overlays and the passage lanes through them are critical to a successful passage of lines in either direction. Obstacles generally do not have lanes in them that are much wider than 50 meters, which restricts them to squad lanes. If a unit is passing through a platoon size lane and finds itself now facing a lane that can be one sixth the size of the lane they just came out of, the potential for a bottleneck is almost unavoidable. So either more lanes need to be cleared through or around obstacles.

The obstacle overlay must include, as a minimum, the precise location of the obstacles and lanes through or bypass routes around them. These lanes should be wide enough for a squad to pass through in a squad column formation with teams in a wedge, which is usually 50 meters wide depending on the terrain. The lanes should be marked prior to the initiation of the passage. These obstacle overlays should be generated by the stationary unit platoon leader or his engineer representative. Types of mines and obstacles should be indicated on the overlay. False minefields must also be annotated on the overlay.

All personnel will learn how to create obstacle overlays, complete with lanes through the minefields, bypasses around minefields, and obstacles to movement. Included on the overlay or accompanying the obstacle overlay should be the range cards for crew served and primary weapons that are trained on the obstacle providing covering or protective fires. All personnel should create an overlay based on a minefield card and obstacle location sheet and transmit it to the company commander. They should also know how to plan for and add a protective fire overlay for both artillery and direct fire weapons based on a scenario with preplanned artillery fires and range cards from the unit responsible for the execution of the minefield or obstacle. This class can be taught in a classroom environment on desktop computers. The culmination of training for obstacle overlays should be integrated with the field training exercise for a passage

of lines, and should also be attended by combat engineer personnel. Soldiers and leaders will be required to emplace a minefield with passage lanes, emplace obstacles with executable bypasses, and create a digital obstacle overlay. The Soldiers and leaders from both must then transmit those items to the next higher headquarters. Remedial training concerning this portion of instruction should be done with IMI and simulation software. Remedial scenarios different from the class scenarios will require creation in order to ensure the plan is not learned, but rather that the concepts are learned.

Post test. The post test could best be done using an IMI test that provides input to a tactical situation. It should emulate selecting certain data that must be on an obstacle overlay which supports the passage of lines as the stationary unit. The final assessment will be conducted during the culminating FTX or ARTEP.

Create a Digital Fire Support Overlay for the Passage of Lines as the Stationary Unit

Requirement. The purpose of this training is to create a fire support overlay for the passage of lines as the stationary unit that meets all the parameters of a standard digital fire support overlay. As a minimum, leaders must be able to create and edit a target reference point (TRP) with all the correct labeling and marginal data.

Training media. The training will be conducted in the classroom using desktop computers loaded with the software or the Soldier computer.

Target population. The target audience is platoon leaders, platoon sergeants, and artillery fire support team members and leaders in support of infantry units.

Method. Training begins with a review, if necessary, of symbols and the requirements for a TRP, and progresses to using the symbols and icon library to create overlays. This is primarily for the benefit of the artillery personnel, but their infantry counterparts can help as coaches during the training. If necessary, there should also be a review of fire support during either a forward or a rearward passage of lines using the more traditional paper method. This should then progress to creating a fire support overlay digitally. Participants should be given tactical situations in which they must develop a fire support plan and then determine what must be forwarded to the passing unit to enhance the passage of lines.

Fire support overlay requirements to train. The fire support overlay starts with the platoon leader and his artillery representative. There is nothing new about fire support planning, so there is not a lot of training required for the fire support overlay. The key portion of training for the fire support overlay is to plan for dead space in both directions from the forward line of troops in a defense, with the passing unit headed either forwards or backwards. This can be done with the line of sight and circular line of sight tools to determine dead space. Another helpful and key piece of information that should be posted to the overlay is the range line of the direct and general support artillery units in support of the stationary unit. Classes taught concerning the fire support overlay should be refresher in nature to ensure all Soldiers and leaders have the skills necessary to develop the overlay and transmit it up both the maneuver command lines and the artillery command lines. The class should be given a tactical situation and the tactical situation should include at least an artillery unit in direct support.

Post test. This could best be done using an IMI test that provides input to a tactical situation. It should emulate selecting certain data that must be on a fire support overlay which

supports the passage of lines as the stationary unit. The final assessment will be conducted during the culminating FTX or ARTEP.

Culmination Exercise

The culmination for this training will be a live field training exercise (FTX) with a minimum of one platoon occupying a defensive position (the stationary unit) complete with obstacles and minefields, while another platoon performs the passage of lines. The passing unit may be infantry, Stryker, or heavy infantry units. The stationary unit should represent an infantry unit, but a Stryker infantry platoon in the defense is acceptable. Ideally the FTX will incorporate both a forward passage of lines, such as an infantry unit passing forward through a defense to conduct an attack, and a rearward passage of lines, such as a covering force returning through the defending unit. Representative combat support players must be incorporated into the training, such as an engineer squad leader and an artillery forward observer or a member of the unit's fire support team to assist in the creation of the obstacle overlay and the fire support overlay. Each of these personnel should be certified as instructors, since they will also be expected to coach and mentor junior leaders in these tasks. Also during the exercise, all crew served weapons personnel should create and transmit a digital range card for their fighting position. All team leaders will submit a digital sector sketch with range cards, and squad leaders will integrate those digital sketches and cards into a digital squad sector sketch, which they will then forward to the platoon leader.

During the culminating FTX, each phase of the passage of lines should have an AAR to maximize the learning that is taking place during the exercise. Ideally the passage of lines should be conducted during both daylight hours and hours of limited visibility. If only one can be done, it should be done during daylight hours to eliminate or reduce confusion and maximize learning opportunities.

Safety

Safety is always a primary concern in training. Soldiers and leaders should be given standard safety briefings concerning the use of blank ammunition, simunitions, heat and cold casualties, depending on the time of year and weather, and operating tracked and wheeled vehicles during hours of limited visibility. This is especially true of training where dismounted and mounted training operations are occurring in the same area.

Conclusions

Conducting either a forward or a rearward passage of lines is one of the more complex and dangerous operations a unit can perform. The danger can come from a lack of communications or understanding by members of the unit that are passing forward or back or the stationary unit. The chances for fratricide are extremely high. However, if a unit has digital communications and command and control, the maximum use of overlays will not only help reduce or eliminate the possibilities of fratricide, but it will reduce the amount of time needed to plan and coordinate a highly intricate passage of lines.

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ACRONYMS

AAR	After action review
AO	Area of operations
ARTEP	Army Training and Evaluation Program
BHL	Battle handover line
BLUFOR	Blue force
C4I	Command and control, communications, computers and intelligence
CADRG	Compressed Arc Digitized Raster Graphic
CCTT	Close Combat Tactical Trainer
CD-ROM	Compact disc – read only memory
CP	Command post
COP	Common operating picture
DA	Department of the Army
DMA	Defense Mapping Agency
DTED	Digital Terrain Elevation Data
DTD	Data transfer device
EP	End point
FBCB2	Force XXI Battle Command Brigade and Below
FFA	Free fire area
FTX	Field training exercise
GPS	Global positioning system
GUI	Graphic user interface
ICV	Infantry Combat Vehicle
IMI	Interactive multi-media instruction
IRP	Initial rally point
MCOO	Modified combined obstacle overlay
MDL	Mission data loader
MGRS	Military Grid Reference System
NAI	Named area of interest
NETT	New Equipment Training Team
NFA	No fire area
NIMA	National Imagery and Mapping Agency
OP	Observation post
OPFOR	Opposing force
PL	Platoon leader
RFL	Restrictive fire line
RP	Rally point
SA	Situational awareness
SL	Squad leader
SMCT	Soldiers' Manual of Common Tasks
SP	Start point
STP	Soldier Training Publication
TL	Team leader
TRP	Target reference point
UDOP	Unit defined operating picture
UTM	Universal Traverse Mercator
VMAP	Vector map